Odor Coding by a Mammalian Receptor Repertoire
Harumi Saito, Qiuyi Chi, Hanyi Zhuang , Hiro Matsunami, Joel D. Mainland

Supplementary Data

Supplementary Figure 1: Dose response curves of all 340 odorant/receptor interactions showing significant receptor activation. For receptors with more than 7 agonists, all of the receptor's agonists not featured in the legend are shown as grey curves. The y-axis denotes the normalized response and the x-axis denotes odorant concentration. Error bars represent standard error.

Supplementary Figure 2: Odorant clustering based on receptor response. To generate this clustering we used the 'linkage' function from Matlab using the 'average' algorithm and standardized Euclidean distance.

Supplementary Figure 3: Receptor clustering based on response to odorants. To generate this clustering we used the 'linkage' function from Matlab using the 'average' algorithm and standardized Euclidean distance.

Supplementary Figure 4: Outline of the screening procedure. Values represent the number of receptors. Percentages represent the surviving percentage out of the initial set of cloned receptors.

Supplementary Figure 5: A phylogenetic tree of all 464 receptors in the screening library as well as 1425 intact mouse and human ORs (Supplementary Table 1). Receptors used in the mixture-screening phase are labeled with open magenta symbols; receptors found to have at least one agonist in this study are labeled with closed green symbols. Mouse receptors are labeled with circles; human receptors are labeled with triangles. Unlabeled lines represent untested receptors. This is a different representation of the same data presented in Fig. 2B.

Supplementary Figure 6: Sensitivity-ordered tuning curves. The 63 odorants are displayed along the x-axis of each subplot according to the strengths of the responses they elicit from each receptor. The odorants that elicit the strongest responses are placed near the center of the distribution; those that elicit the weakest responses are placed near the edges. The order of odorants is thus different for different receptors. The y-axis is the EC50 of the odorant-receptor interaction. The 62 tuning-curve graphs are ordered by the number of agonists for each receptor.

Supplementary Figure 7: One-dimensional tuning curves. The 63 odorants are plotted along the x-axis of each subplot according to the first principal component of the odorant in Haddad et al.'s odor space (Haddad et al., 2008, Nature Methods, 5(5), 425-9). The order of odorants is the same for different receptors. The y-axis is the EC50 of the odorant-receptor interaction. The 62 tuning-curve

graphs are ordered by the number of agonists for each receptor.

Supplementary Figure 8: Two-dimensional tuning plots. A two-dimensional projection of 2,683 odorants in Haddad et al.'s odor space (Haddad et al., 2008, Nature Methods, 5(5), 425-9) is plotted in grey. A given receptor's agonists are plotted in red in the respective subplots. A circle circumscribing all agonists is drawn in blue. The 62 tuning-curve graphs are ordered by the number of agonists for each receptor. In the upper left of each subplot is the radius of a hypersphere enclosing all of the receptor's agonists; in the upper right is the number of agonists.

Supplementary Figure 9: Snake plot of a typical OR in which amino acid residues with ligand-specificity-determining properties are highlighted. Residue properties selected by the greedy optimization algorithm are indicated by color. Residues previously predicted to be ligand-specificity determining (Man et al., 2004, Protein Sci, 13(1), 240-54) are outlined in dark blue. Note that only one of the previously predicted residues (in the third transmembrane domain) was selected by our algorithm. Amino acid positions conserved in at least 90% of the 1425 receptors are labeled with their single-letter amino acid code. Abbreviations for the amino acid residues are as follows: A, Ala; C, Cys; D, Asp; F, Phe; G, Gly; H, His; I, Ile; K, Lys; L, Leu; M, Met; N, Asn; P, Pro; Q, Gln; R, Arg; S, Ser; T, Thr; and Y, Tyr.

Supplementary Figure 10: EC50 values for 62 odorant receptors and 63 odorants. Class I receptors are shown in green, class II receptors in purple on the y-axis. Human odorant receptors have a gray background. Receptors are ordered according to the number of agonists identified in our dataset. Odorants are colored by functional group on the x-axis: Red=Aliphatic carboxylic acids, Light green=Aliphatic alcohols, Turquoise=Aliphatic aldehydes, Light blue=Aliphatic ketones, Green = Diketones, Dark purple=Aliphatic esters, Orange=Thiols, Black=Aromatics, Rust=Cyclic ketones, Light purple=Aliphatic aromatic ketones, Yellow=Aromatic carboxylic acids, Cherry=aromatic aldehyde, Blue=Aliphatic esters.

Supplementary Table 1: Multiple alignment of all 464 receptors in the screening library as well as 1425 intact mouse and human ORs from (Niimura et al., 2005, Gene, 346, 23-8) in FASTA format. Receptors in the screening library follow the naming convention of (Glusman et al., 2001, Genome Res, 11, 685-702), but are prefixed with an 'S'.

Supplementary Table 2: Odorants used to screen the receptor libraries. During the mixture screening stage the odorants were divided by functional group into 8 mixtures as indicated. Note that prenyl acetate was used in two different mixtures.

Supplementary Table 3: The numerical EC50 values (log M) displayed in Fig. 1

Supplementary Table 4: CAS registry numbers for 2,683 odorants used to estimate the size of odorant space. Structure files were obtained from (http://www.thegoodscentscompany.com).

Supplementary Table 5: 16 amino acid property descriptors that explain over 53% of the variance in our dataset. Note that some descriptors have a weight higher than one.

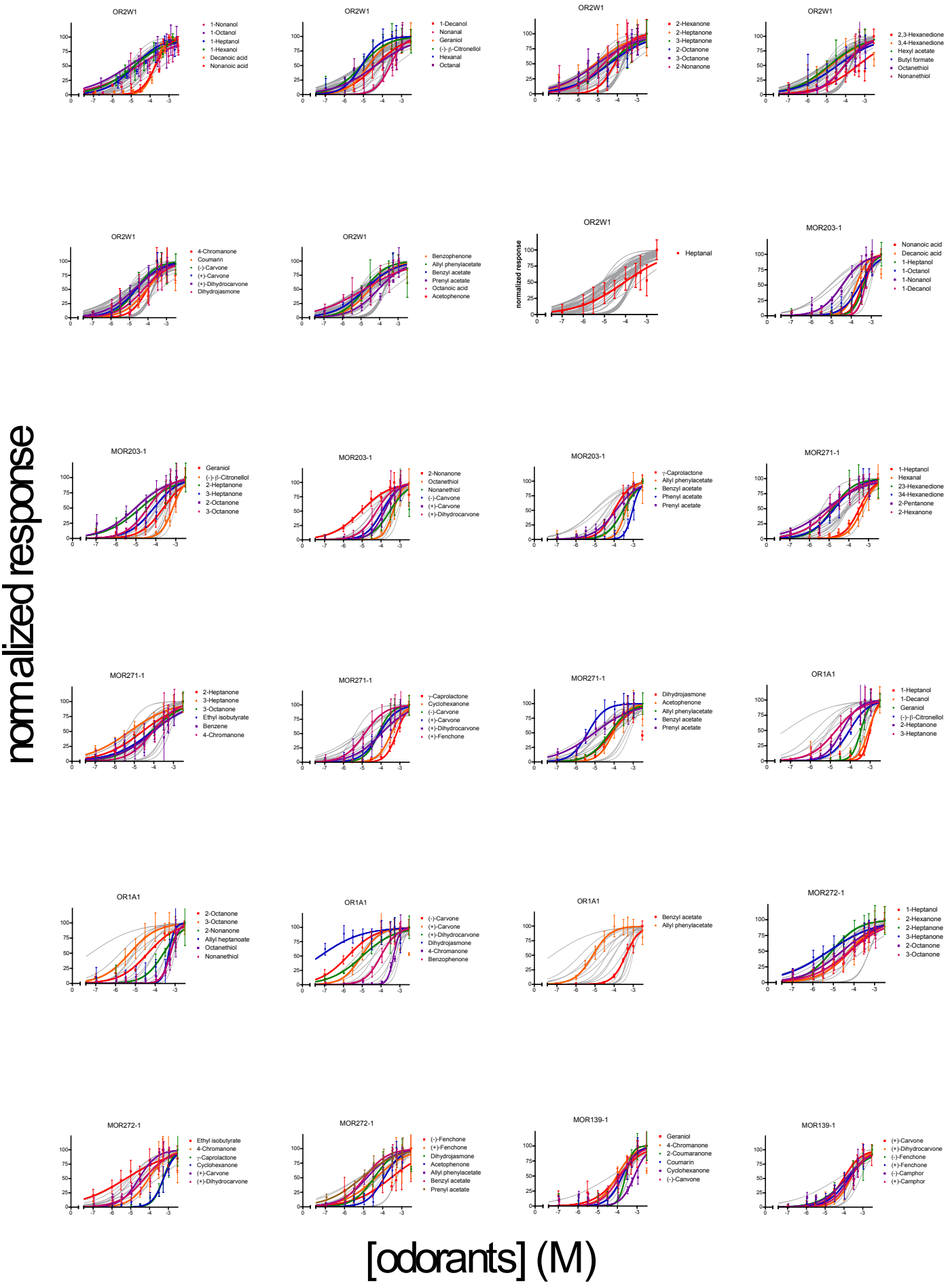


Figure S1. Dose response curves of all 340 odorant/receptor interactions showing significant receptor activation. For receptors with more than 7 agonists, all of the receptor's agonists not featured in the legend are shown as grey curves. The y-axis denotes the normalized response and the x-axis denotes odorant concentration. Error bars represent standard error.

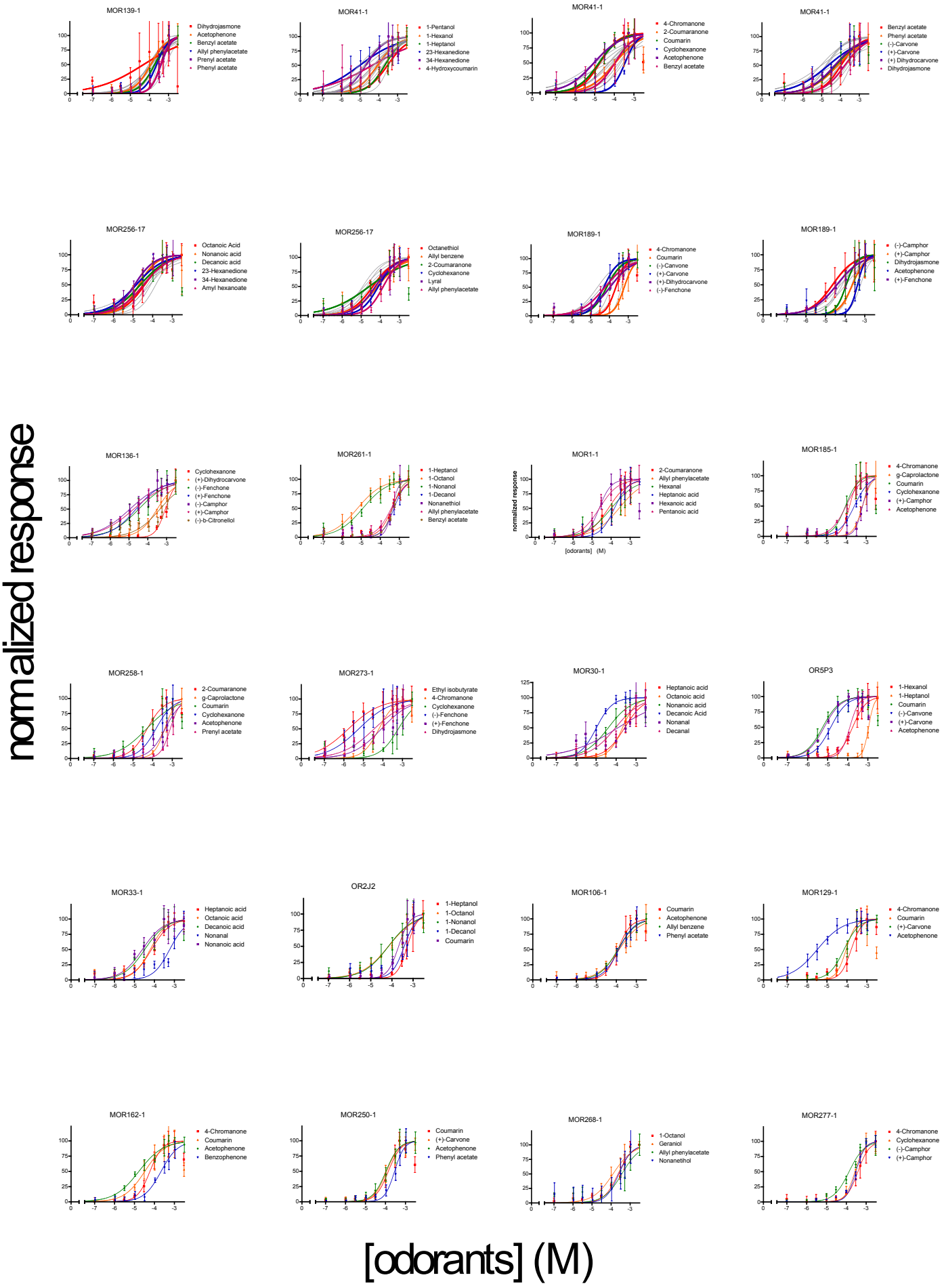


Figure S1 (continued). Dose response curves of all 340 odorant/receptor interactions showing significant receptor activation. For receptors with more than 7 agonists, all of the receptor's agonists not featured in the legend are shown as grey curves. The y-axis denotes the normalized response and the x-axis denotes odorant concentration. Error bars represent standard error.

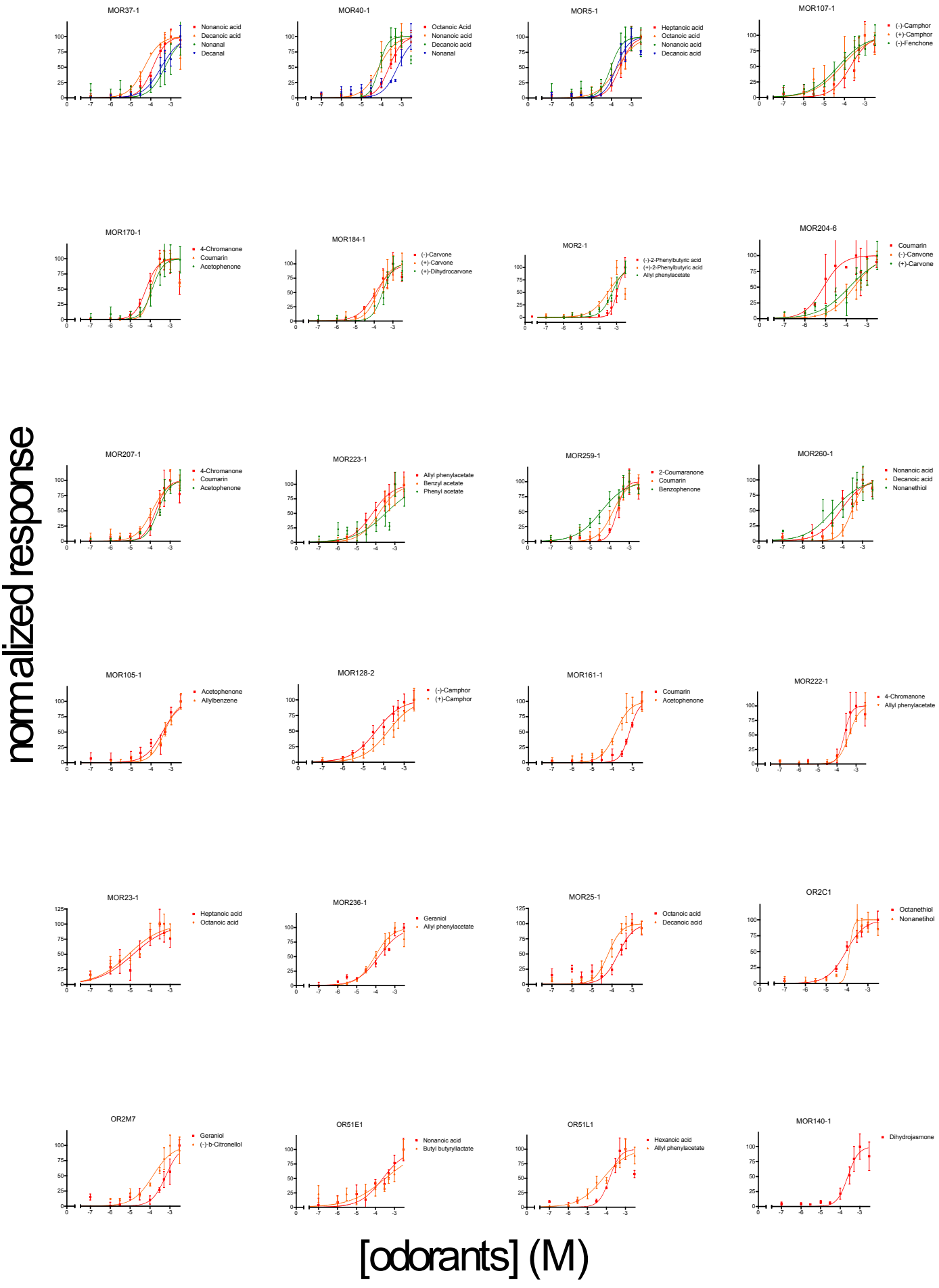
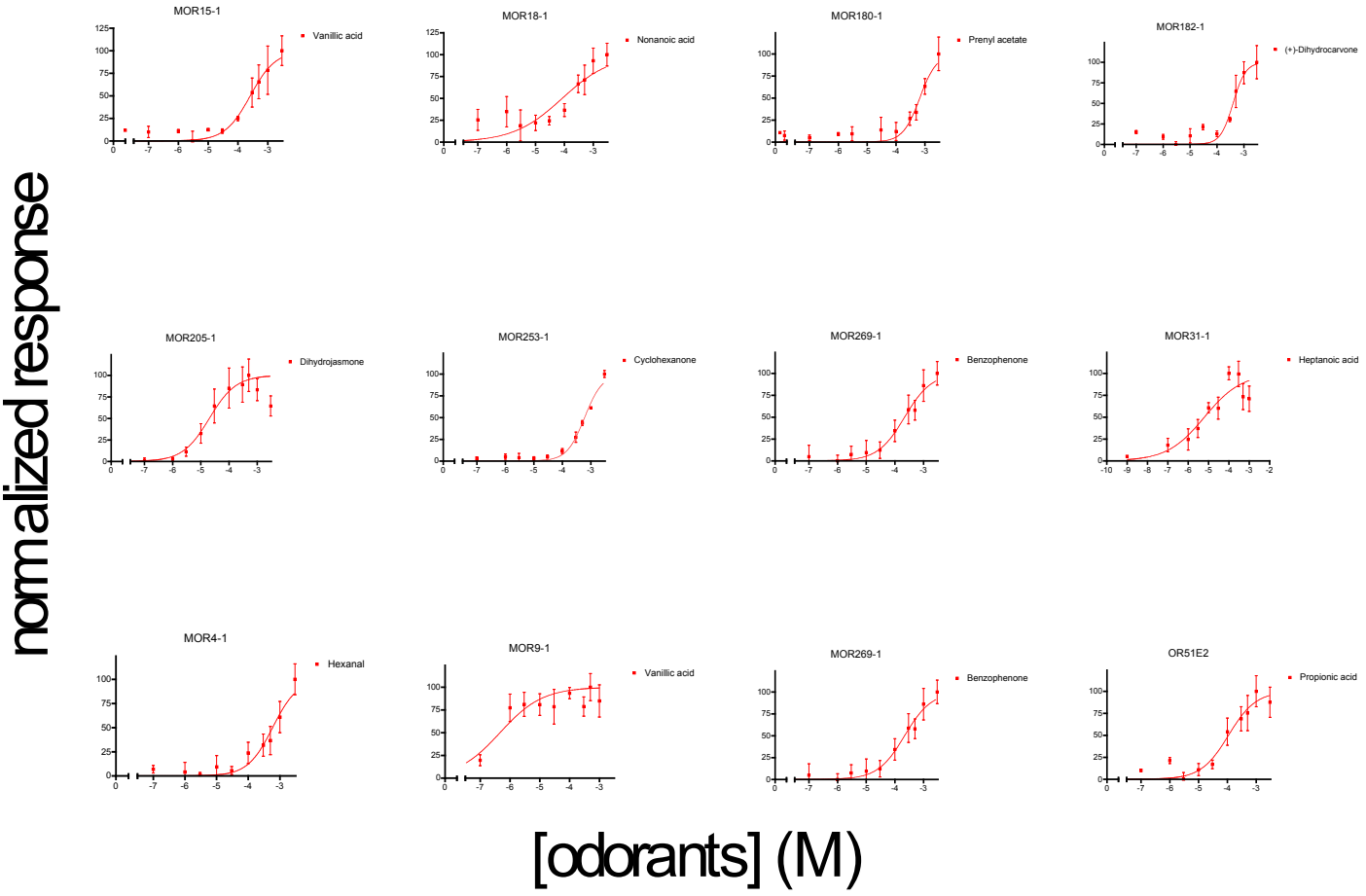


Figure S1 (continued). Dose response curves of all 340 odorant/receptor interactions showing significant receptor activation. For receptors with more than 7 agonists, all of the receptor's agonists not featured in the legend are shown as grey curves. The y-axis denotes the normalized response and the x-axis denotes odorant concentration. Error bars represent standard error.



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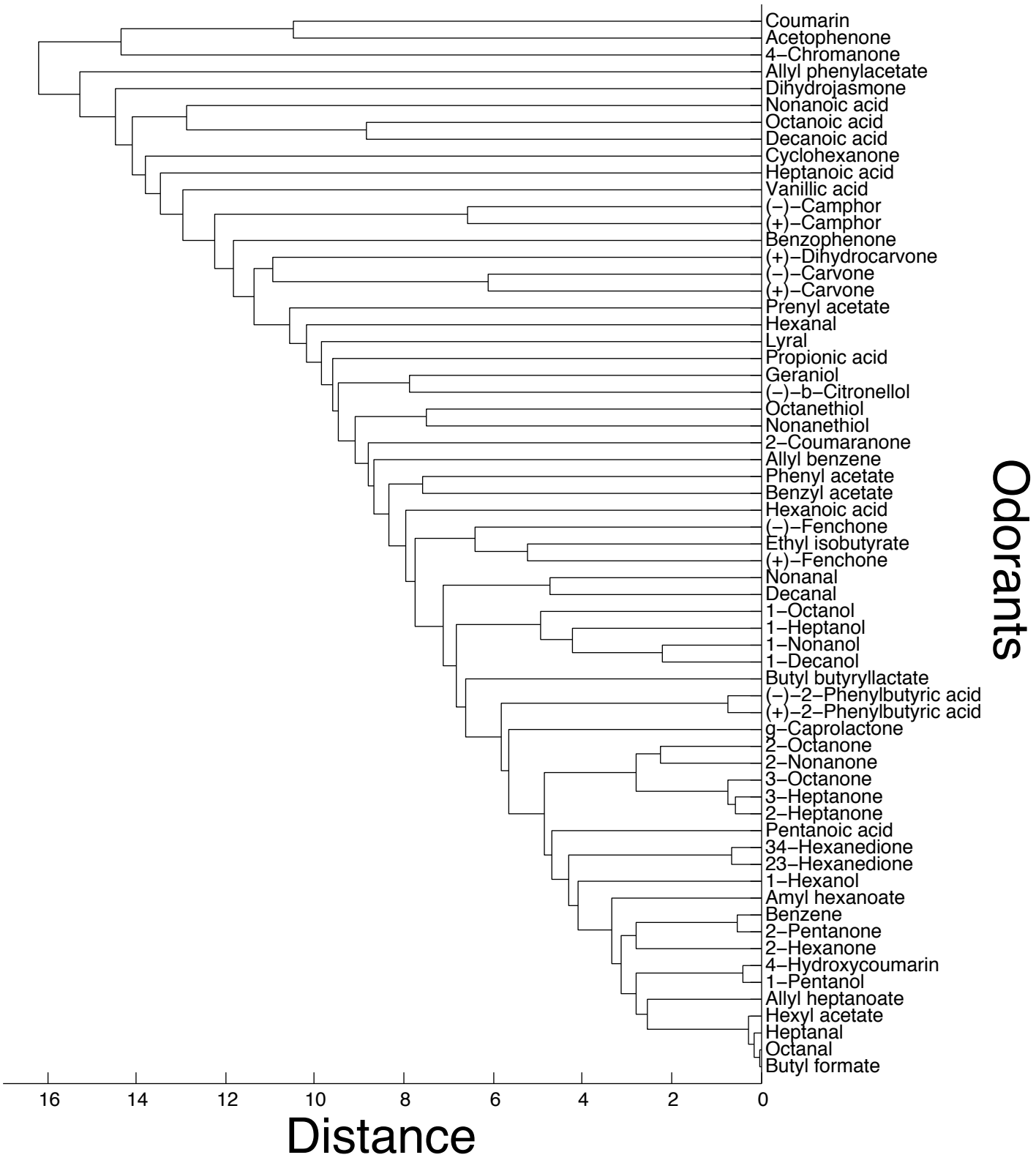


Figure S2. Odorant clustering based on receptor response. To generate this clustering we used the 'linkage' function from Matlab using the 'average' algorithm and standardized Euclidean distance.

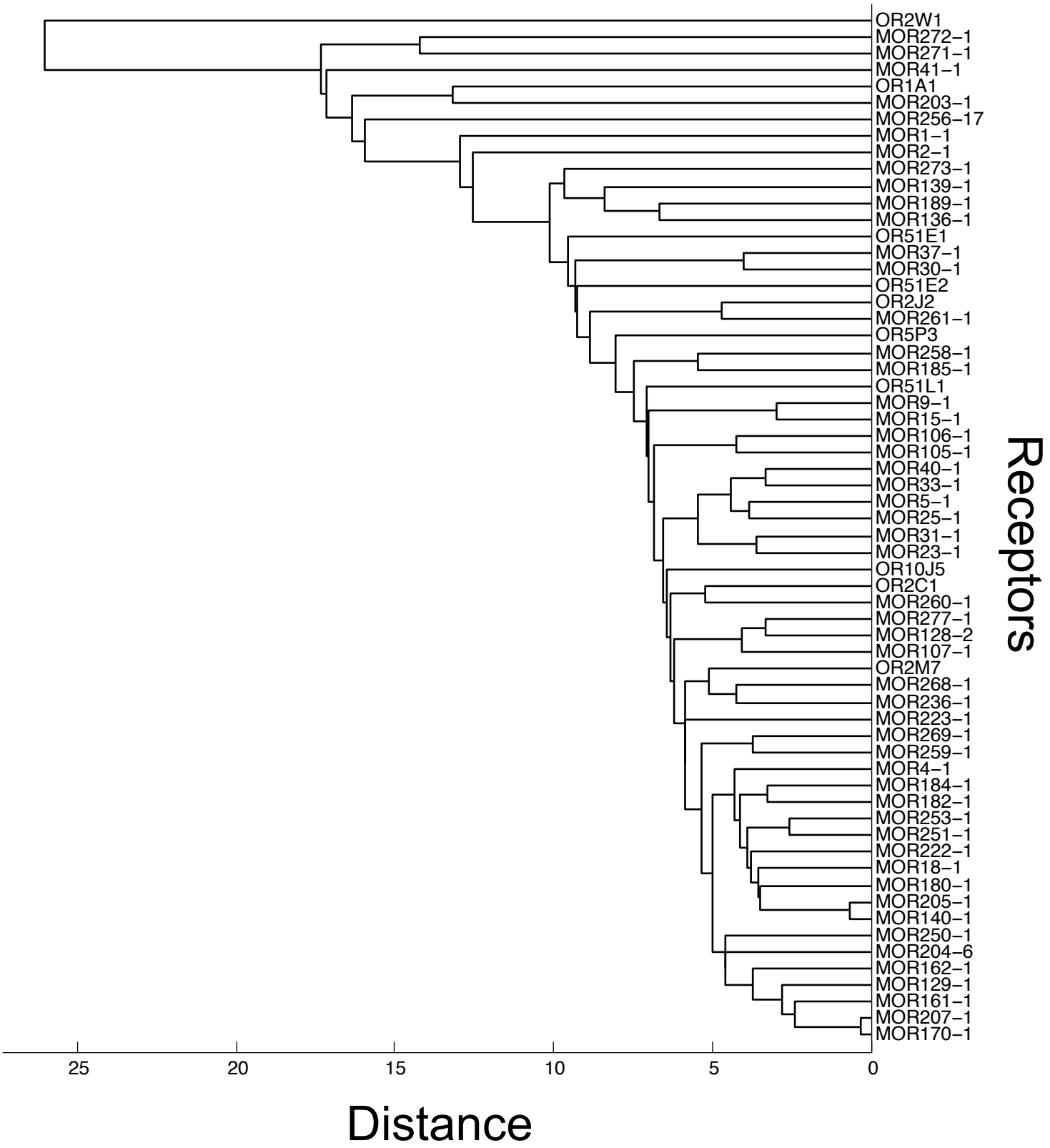


Figure S3. Receptor clustering based on response to odorants. To generate this clustering we used the ‘linkage’ function from Matlab using the 'average' algorithm and standardized Euclidean distance.

Screening procedure

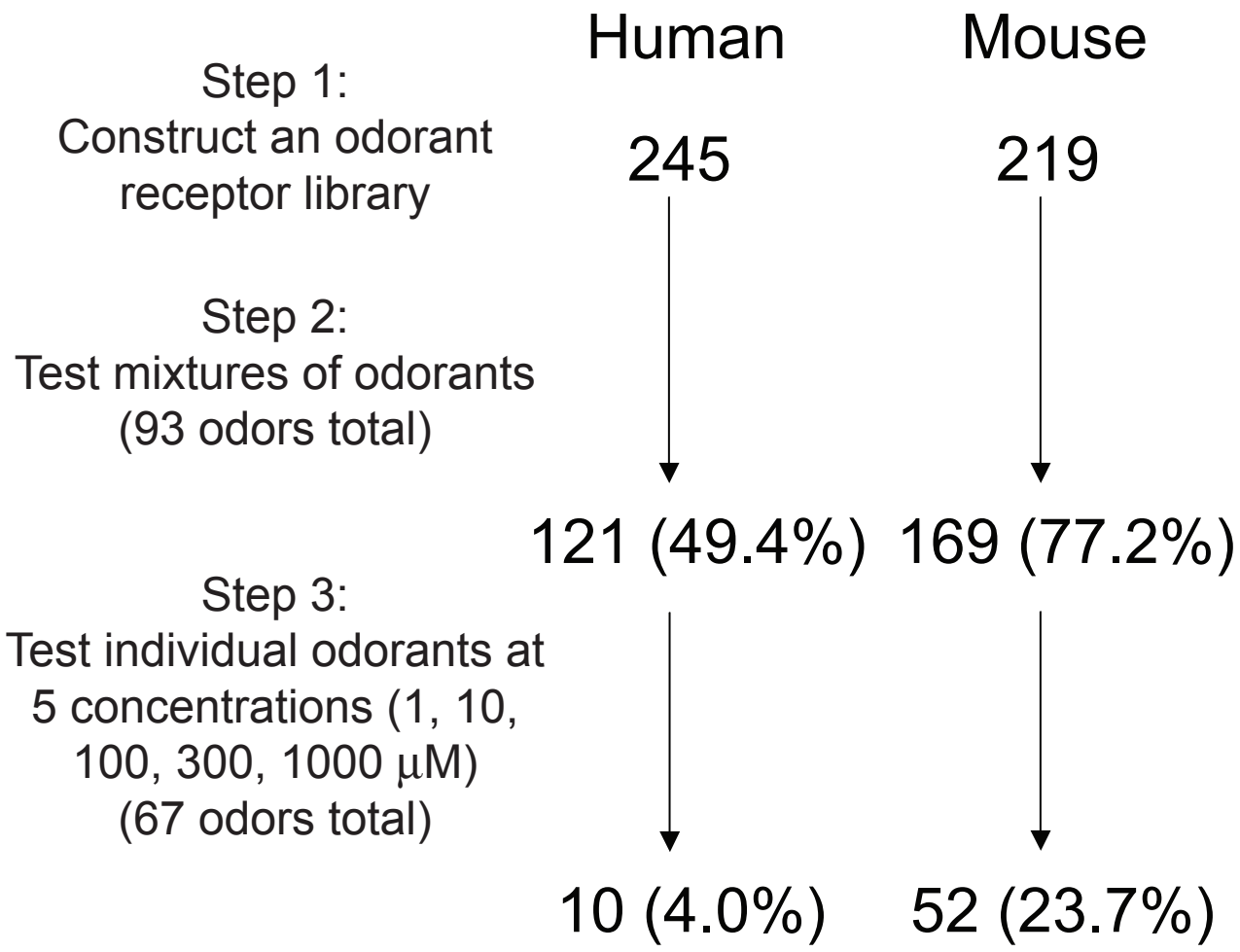


Figure S4. Outline of the screening procedure. Values represent the number of receptors. Percentages represent the surviving percentage out of the initial set of cloned receptors.

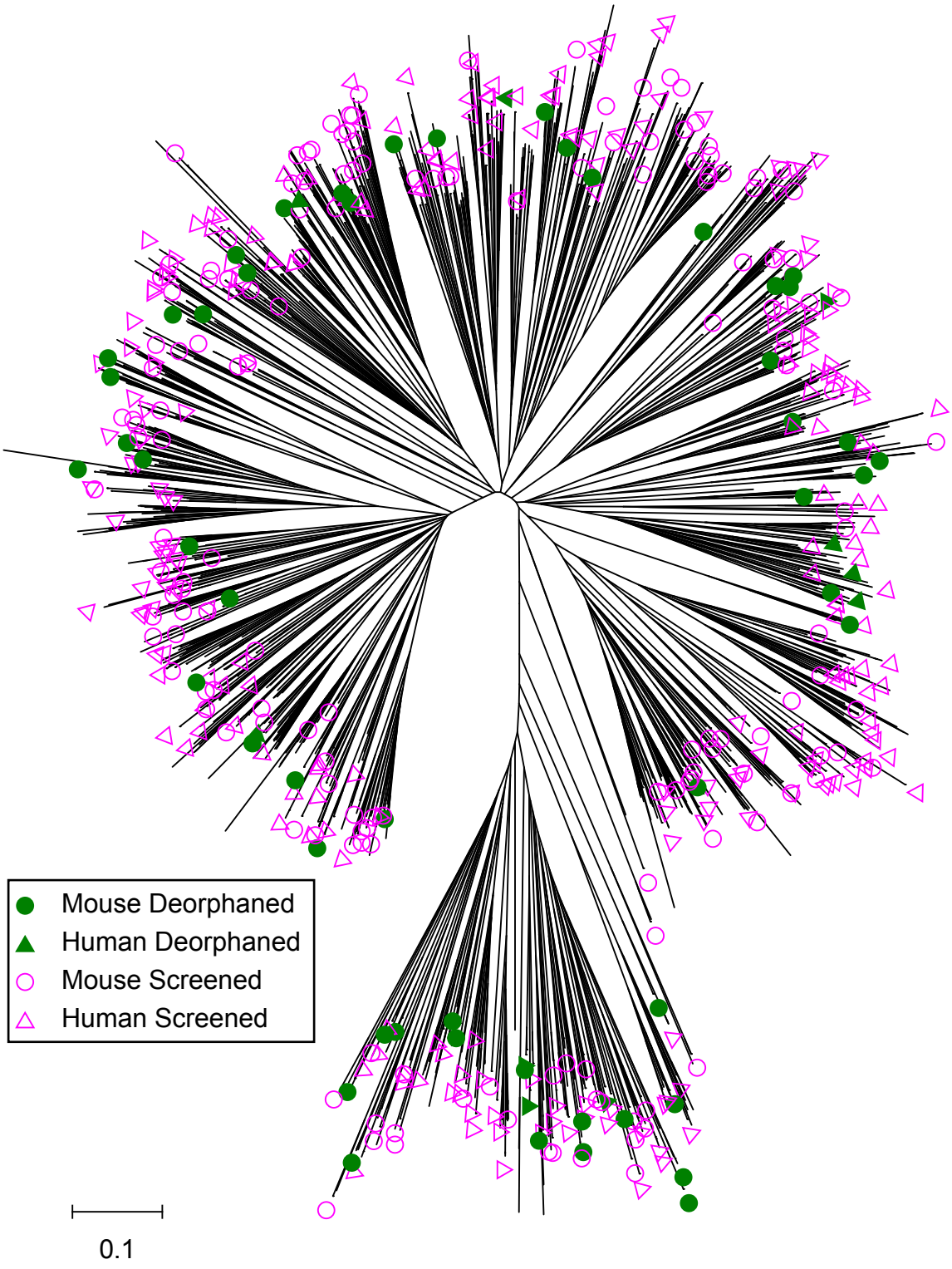


Figure S5. A phylogenetic tree of all 464 receptors in the screening library as well as 1425 intact mouse and human ORs (Supplementary Table 1). Receptors used in the mixture-screening phase are labeled with open magenta symbols; receptors found to have at least one agonist in this study are labeled with closed green symbols. Mouse receptors are labeled with circles; human receptors are labeled with triangles. Unlabeled lines represent untested receptors. This is a different representation of the same data presented in Fig. 2B.

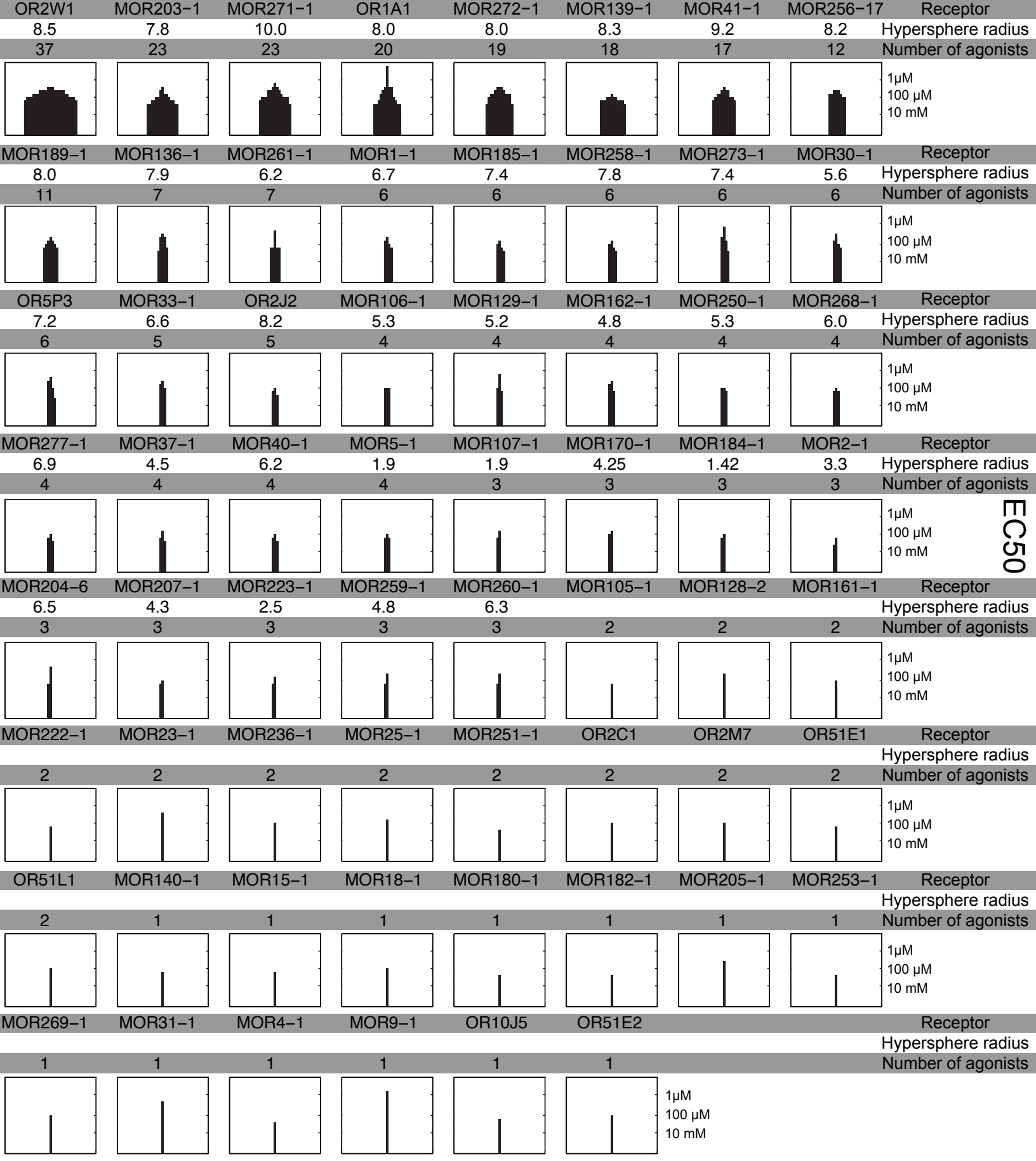


Figure S6. Sensitivity-ordered tuning curves. The 63 odorants are displayed along the x-axis of each subplot according to the strengths of the responses they elicit from each receptor. The odorants that elicit the strongest responses are placed near the center of the distribution; those that elicit the weakest responses are placed near the edges. The order of odorants is thus different for different receptors. The y-axis is the EC50 of the odorant-receptor interaction. The 62 tuning-curve graphs are ordered by the number of agonists for each receptor.

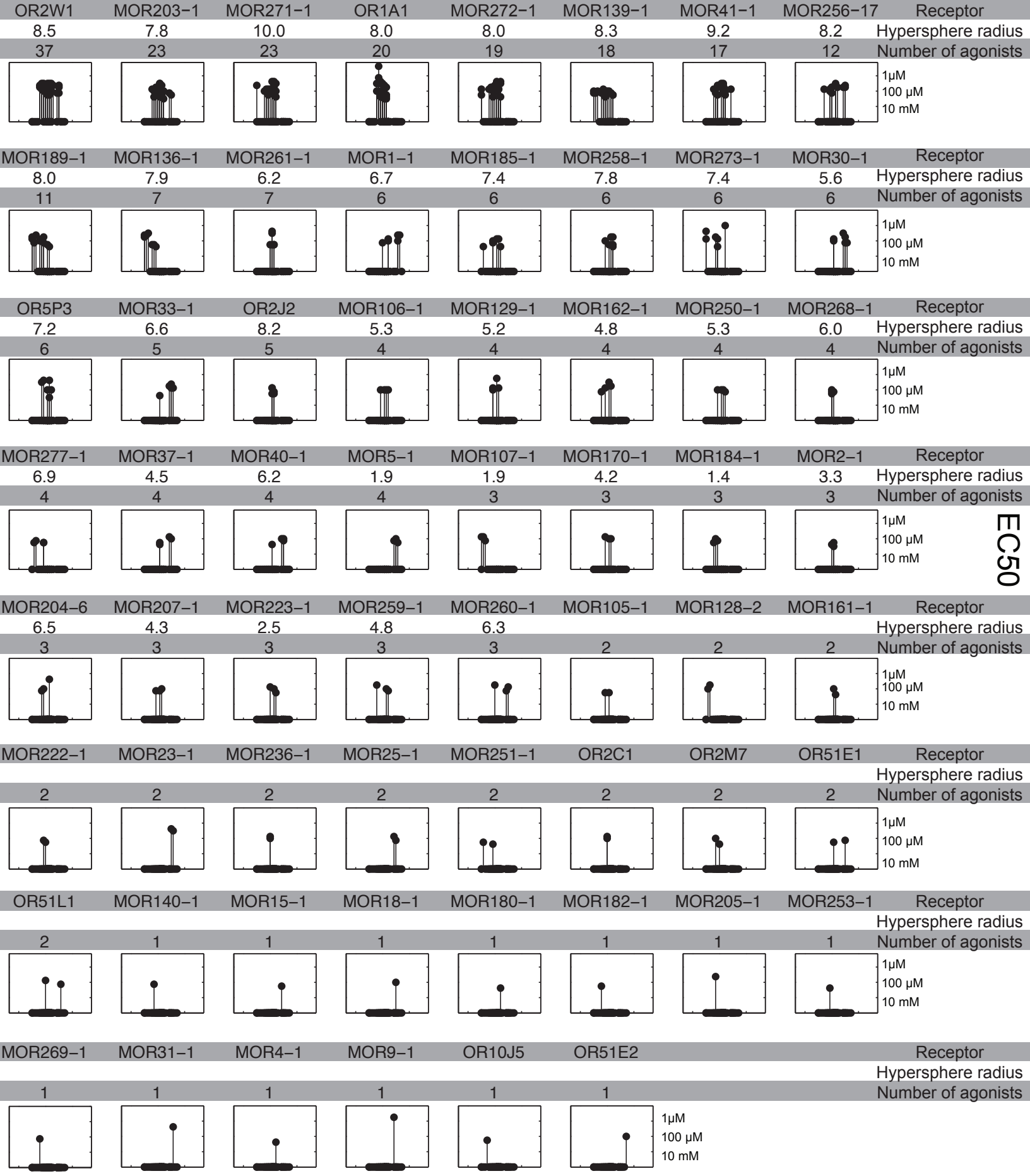


Figure S7. One-dimensional tuning curves. The 63 odorants are plotted along the x-axis of each subplot according to the first principal component of the odorant in Haddad et al.'s odor space (Haddad et al., 2008, Nature Methods, 5(5), 425-9). The order of odorants is the same for different receptors. The y-axis is the EC50 of the odorant-receptor interaction. The 62 tuning-curve graphs are ordered by the number of agonists for each receptor.

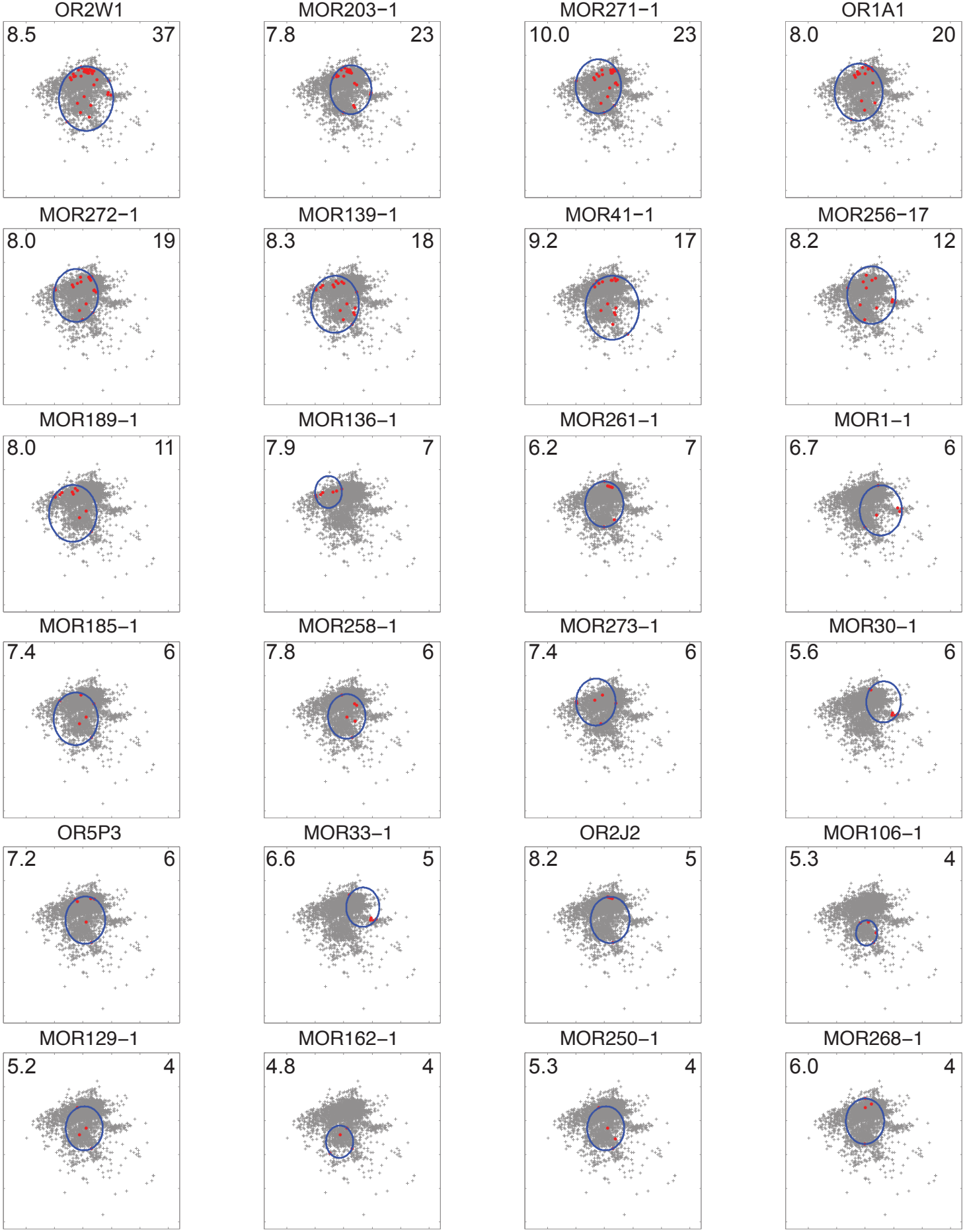
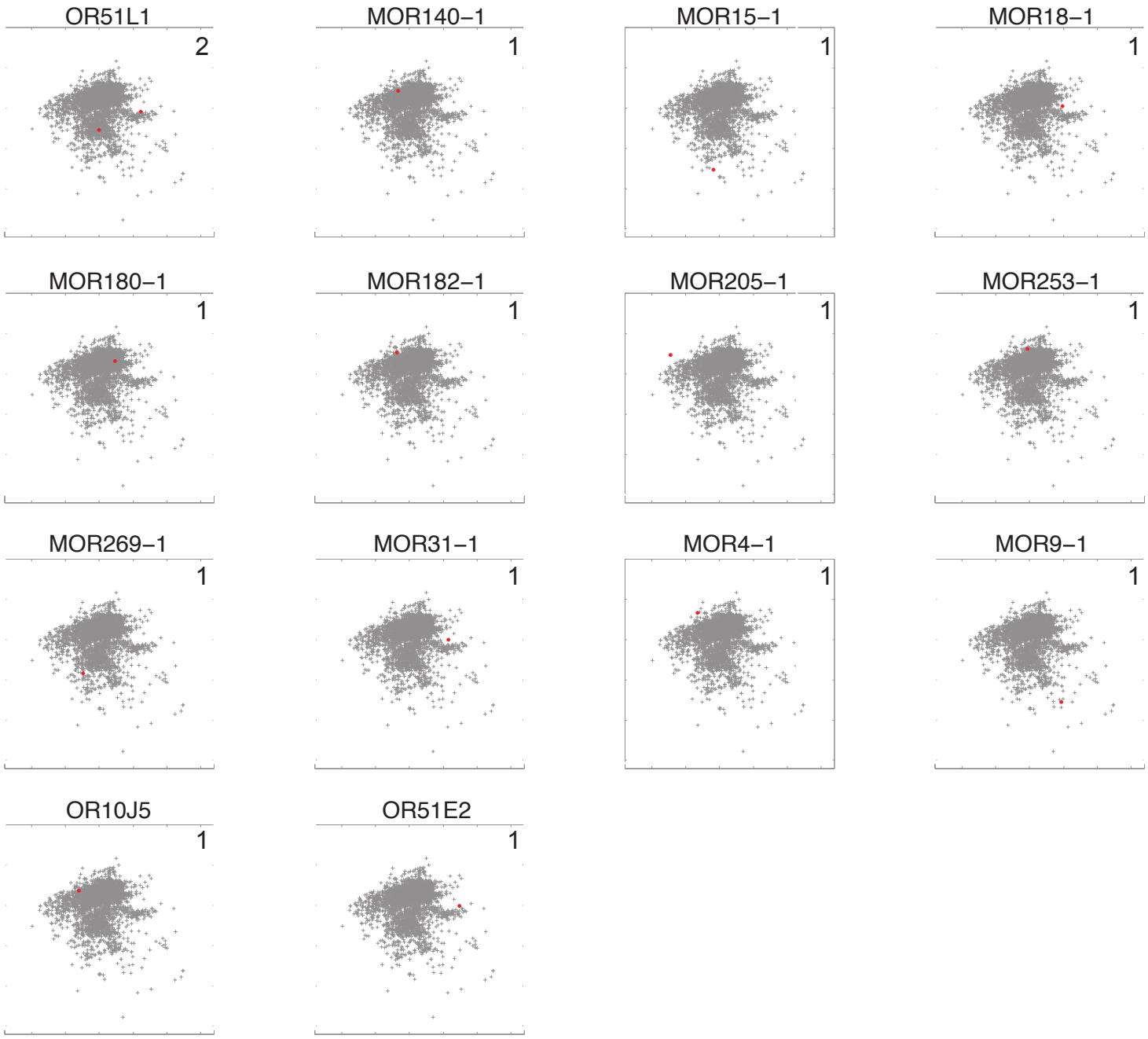


Figure S8. Two-dimensional tuning plots. A two-dimensional projection of 2,683 odorants in Haddad et al.'s odor space (Haddad et al., 2008, Nature Methods, 5(5), 425-9) is plotted in grey. A given receptor's agonists are plotted in red in the respective subplots. A circle circumscribing all agonists is drawn in blue. The 62 tuning-curve graphs are ordered by the number of agonists for each receptor. In the upper left of each subplot is the radius of a hypersphere enclosing all of the receptor's agonists; in the upper right is the number of agonists.

Figure S8 (continued). Two-dimensional tuning plots. A two-dimensional projection of 2,683 odorants in Haddad et al.'s odor space (Haddad et al., 2008, Nature Methods, 5(5), 425-9) is plotted in grey. A given receptor's agonists are plotted in red in the respective subplots. A circle circumscribing all agonists is drawn in blue. The 62 tuning-curve graphs are ordered by the number of agonists for each receptor. In the upper left of each subplot is the radius of a hypersphere enclosing all of the receptor's agonists; in the upper right is the number of agonists.



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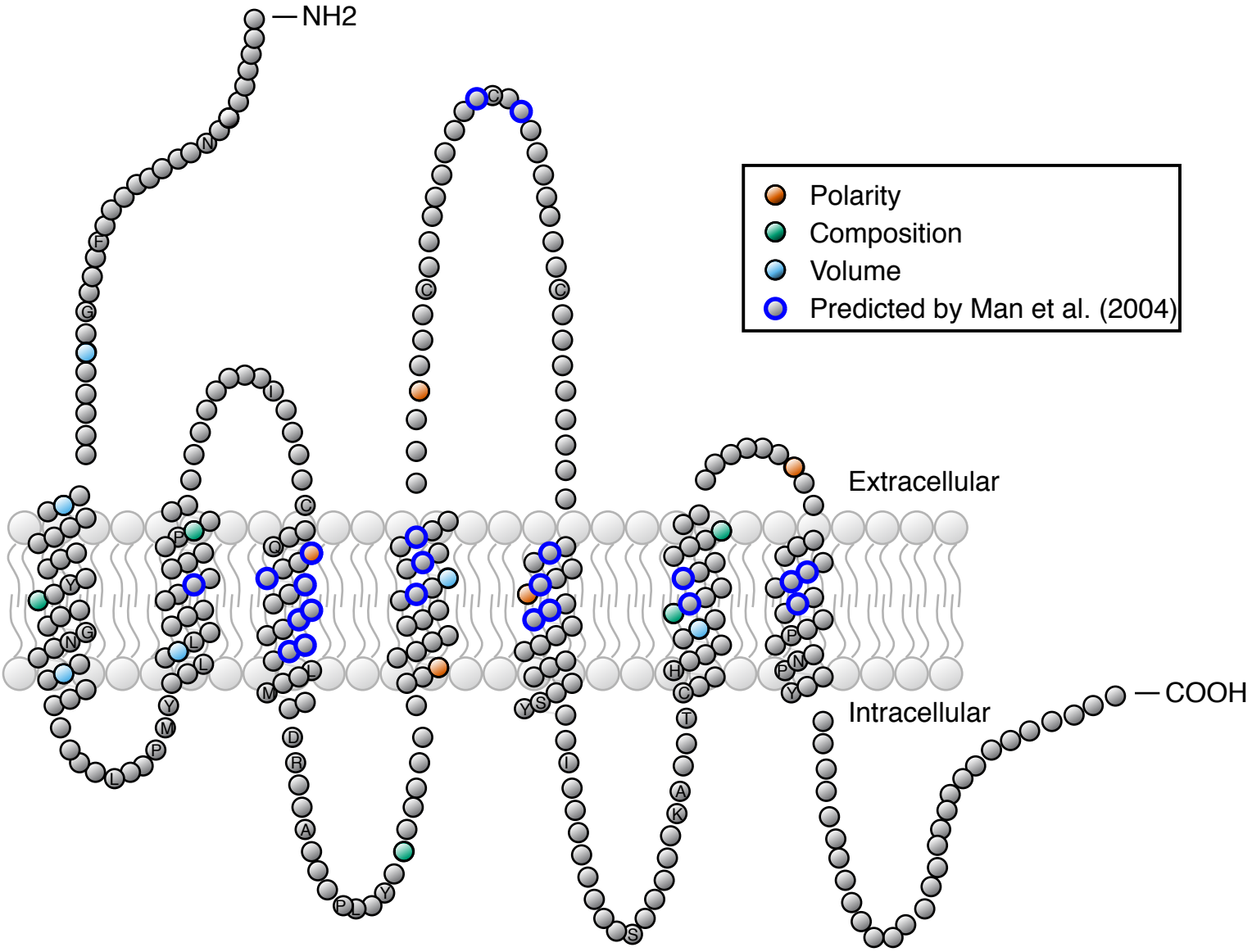

Figure S9. Snake plot of a typical OR in which amino acid residues with ligand-specificity-determining properties are highlighted. Residue properties selected by the greedy optimization algorithm are indicated by color. Residues previously predicted to be ligand-specificity determining (Man et al., 2004, Protein Sci, 13(1), 240-54) are outlined in dark blue. Note that only one of the previously predicted residues (in the third transmembrane domain) was selected by our algorithm. Amino acid positions conserved in at least 90% of the 1425 receptors are labeled with their single-letter amino acid code. Abbreviations for the amino acid residues are as follows: A, Ala; C, Cys; D, Asp; F, Phe; G, Gly; H, His; I, Ile; K, Lys; L, Leu; M, Met; N, Asn; P, Pro; Q, Gln; R, Arg; S, Ser; T, Thr; and Y, Tyr.

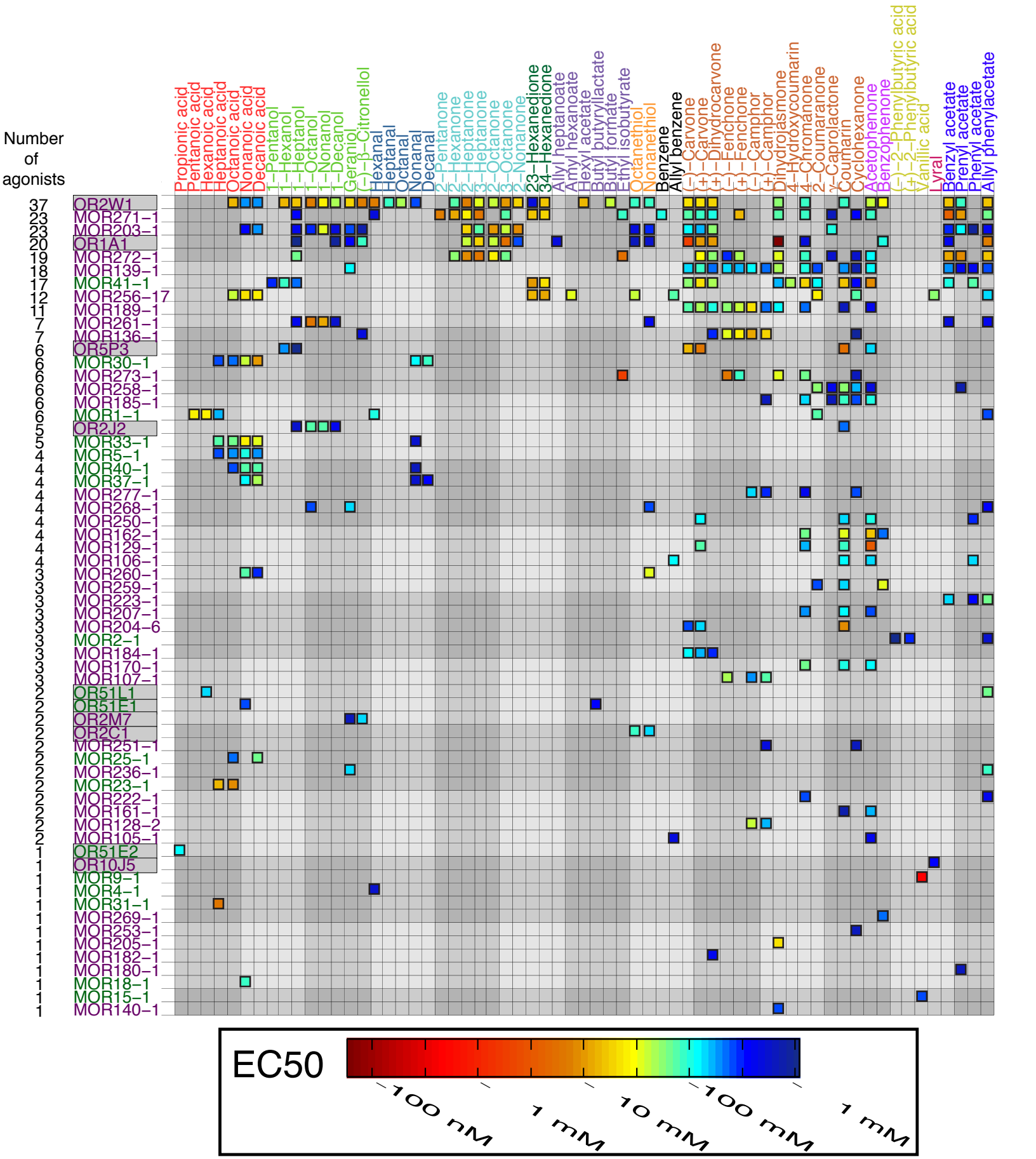

Figure S10. EC50 values for 62 odorant receptors and 63 odorants. Class I receptors are shown in green, class II receptors in purple on the y-axis. Human odorant receptors have a gray background. Receptors are ordered according to the number of agonists identified in our dataset. Odorants are colored by functional group on the x-axis: Red=Aliphatic carboxylic acids, Light green=Aliphatic alcohols, Turquoise=Aliphatic aldehydes, Light blue=Aliphatic ketones, Green = Diketones, Dark purple=Aliphatic esters, Orange=Thiols, Black=Aromatics, Rust=Cyclic ketones, Light purple=Aliphatic aromatic ketones, Yellow=Aromatic carboxylic acids, Cherry=aromatic aldehyde, Blue=Aliphatic esters.

Odorant Set 1	Odotant Set 2	Odorant Set 3	Odorant set 4
Pentanoic acid	4-Hydroxycoumarin	2-Butanone	tert-Butyl propionate
Propionic acid	4-Chromanone	2-Pentanone	Methyl butyrate
Hexanoic acid	2-Coumaranone	2-Hexanone	Propyl butyrate
Heptanoic acid	γ-Caprolactone	2-Heptanone	Pentyl acetate
Octanoic Acid	Coumarin	3-Heptanone	Allyl heptanoate
Nonanoic acid	Cyclohexanone	2-Octanone	Amyl hexanoate
Decanoic acid		3-Octanone	Amyl butyrate
Isovaleric acid		2-Nonanone	Butyl heptanoate
Thioglycolic acid		2,3-Hexanedione	Heptyl isobutyrate
Nonanedioic acid		3,4-Hexanedione	Hexyl acetate
Vanillic acid		(+)-Carvone	Butyl butyryllactate
(+)-2-Phenylbutyric acid		(-)-Carvone	Butyl formate
(-)-2-Phenylbutyric acid		(+)-Dihydrocarvone	Ethyl pyruvate
		(-)-Fenchone	Isoamyl acetate
		(+)-Fenchone	Ethyl isobutyrate
		(+)-Camphor	Prenyl acetate
		(-)-Camphor	
		Dihydrojasmone	
		Acetophenone	
		Benzophenone	
		(+)-Pulegone	
		2-Furyl methyl ketone	
		Dimedone	
		(-)-Menthone	
		Ionone	

Odorant set 5	Odorant set 6	Odorant set 7	Odorant set 8
1-Butanol	Allyl phenylacetate	Octanethiol	Butanal
1-Propanol	Benzene	Nonanethiol	Pentanal
1-Pentanol	Benzyl acetate		Hexanal
1-Hexanol	Allylbenzene		Heptanal
1-Heptanol	Phenyl acetate		Octanal
1-Octanol	Prenyl acetate		Nonanal
1-Nonanol			Decanal
1-Decanol			Acetal
(+)-2-Heptanol			Citral
(-)-2-Octanol			Hydroxycitronellal
(+)-2-Octanol			Lyral
(-)-β-Citronellol			
Geraniol			
Linalool			
1-Undecanol			

Supplementary Table 2: Odorants used 1o screen the receptor libraries. During the mixture screening stage the odorants were divided by functional group into 8 mixtures as indicated. Note that prenyl acetate was used in two different mixtures.

	(+)-2-Phenylbutyric acid	(+)-Camphor	(+)-Carvone	(+)-Dihydrocarvone	(+)-Fenchone	(-)-2-Phenylbutyric acid	(-)-Camphor
MOR1-1	0	0	0	0	0	0	0
MOR105-1	0	0	0	0	0	0	0
MOR106-1	0	0	0	0	0	0	0
MOR107-1	0	-4.15	0	0	0	0	-3.704
MOR128-2	0	-3.772	0	0	0	0	-4.373
MOR129-1	0	0	-4.145	0	0	0	0
MOR136-1	0	-4.749	0	-3.498	-4.626	0	-4.952
MOR139-1	0	-3.681	-4.032	-3.637	-3.773	0	-3.902
MOR140-1	0	0	0	0	0	0	0
MOR15-1	0	0	0	0	0	0	0
MOR161-1	0	0	0	0	0	0	0
MOR162-1	0	0	0	0	0	0	0
MOR170-1	0	0	0	0	0	0	0
MOR18-1	0	0	0	0	0	0	0
MOR180-1	0	0	0	0	0	0	0
MOR182-1	0	0	0	-3.406	0	0	0
MOR184-1	0	0	-3.812	-3.55	0	0	0
MOR185-1	0	-3.18	0	0	0	0	0
MOR189-1	0	-3.631	-4.302	-3.976	-4.423	0	-4.639
MOR2-1	-3.499	0	0	0	0	-2.982	0
MOR203-1	0	0	-3.814	-4.241	0	0	0
MOR204-6	0	0	-3.85	0	0	0	0
MOR205-1	0	0	0	0	0	0	0
MOR207-1	0	0	0	0	0	0	0
MOR222-1	0	0	0	0	0	0	0
MOR223-1	0	0	0	0	0	0	0
MOR23-1	0	0	0	0	0	0	0
MOR236-1	0	0	0	0	0	0	0
MOR25-1	0	0	0	0	0	0	0
MOR250-1	0	0	-3.938	0	0	0	0
MOR251-1	0	-3.31	0	0	0	0	0
MOR253-1	0	0	0	0	0	0	0
MOR256-17	0	0	0	0	0	0	0
MOR258-1	0	0	0	0	0	0	0
MOR259-1	0	0	0	0	0	0	0
MOR260-1	0	0	0	0	0	0	0
MOR261-1	0	0	0	0	0	0	0
MOR268-1	0	0	0	0	0	0	0
MOR269-1	0	0	0	0	0	0	0
MOR271-1	0	0	-4.096	-3.987	-4.869	0	0
MOR272-1	0	0	-4.564	-4.273	-4.36	0	0
MOR273-1	0	0	0	0	-4.073	0	0
MOR277-1	0	-3.519	0	0	0	0	-3.861
MOR30-1	0	0	0	0	0	0	0
MOR31-1	0	0	0	0	0	0	0
MOR33-1	0	0	0	0	0	0	0
MOR37-1	0	0	0	0	0	0	0
MOR4-1	0	0	0	0	0	0	0
MOR40-1	0	0	0	0	0	0	0
MOR41-1	0	0	-4.644	-4.301	0	0	0
MOR5-1	0	0	0	0	0	0	0
MOR9-1	0	0	0	0	0	0	0
OR10J5	0	0	0	0	0	0	0
OR1A1	0	0	-5.035	-4.992	0	0	0
OR2C1	0	0	0	0	0	0	0
OR2J2	0	0	0	0	0	0	0
OR2M7	0	0	0	0	0	0	0
OR2W1	0	0	-4.646	-4.755	0	0	0
OR51E1	0	0	0	0	0	0	0
OR51E2	0	0	0	0	0	0	0
OR51L1	0	0	0	0	0	0	0
OR5P3	0	0	-5.173	0	0	0	0

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

	(-)-Carvone	(-)-Fenchone	(-)-b-Citronellol	1-Decanol	1-Heptanol	1-Hexanol	1-Nonanol	1-Octanol	1-Pentanol
MOR1-1	0	0	0	0	0	0	0	0	0
MOR105-1	0	0	0	0	0	0	0	0	0
MOR106-1	0	0	0	0	0	0	0	0	0
MOR107-1	0	-4.302	0	0	0	0	0	0	0
MOR128-2	0	0	0	0	0	0	0	0	0
MOR129-1	0	0	0	0	0	0	0	0	0
MOR136-1	0	-4.481	-3.347	0	0	0	0	0	0
MOR139-1	-3.861	-3.879	0	0	0	0	0	0	0
MOR140-1	0	0	0	0	0	0	0	0	0
MOR15-1	0	0	0	0	0	0	0	0	0
MOR161-1	0	0	0	0	0	0	0	0	0
MOR162-1	0	0	0	0	0	0	0	0	0
MOR170-1	0	0	0	0	0	0	0	0	0
MOR18-1	0	0	0	0	0	0	0	0	0
MOR180-1	0	0	0	0	0	0	0	0	0
MOR182-1	0	0	0	0	0	0	0	0	0
MOR184-1	-3.92	0	0	0	0	0	0	0	0
MOR185-1	0	0	0	0	0	0	0	0	0
MOR189-1	-4.147	-4.239	0	0	0	0	0	0	0
MOR2-1	0	0	0	0	0	0	0	0	0
MOR203-1	-3.936	0	-3.147	-3.299	-3.387	0	-4.456	-3.563	0
MOR204-6	-3.625	0	0	0	0	0	0	0	0
MOR205-1	0	0	0	0	0	0	0	0	0
MOR207-1	0	0	0	0	0	0	0	0	0
MOR222-1	0	0	0	0	0	0	0	0	0
MOR223-1	0	0	0	0	0	0	0	0	0
MOR23-1	0	0	0	0	0	0	0	0	0
MOR236-1	0	0	0	0	0	0	0	0	0
MOR25-1	0	0	0	0	0	0	0	0	0
MOR250-1	0	0	0	0	0	0	0	0	0
MOR251-1	0	0	0	0	0	0	0	0	0
MOR253-1	0	0	0	0	0	0	0	0	0
MOR256-17	0	0	0	0	0	0	0	0	0
MOR258-1	0	0	0	0	0	0	0	0	0
MOR259-1	0	0	0	0	0	0	0	0	0
MOR260-1	0	0	0	0	0	0	0	0	0
MOR261-1	0	0	0	-3.273	-3.382	0	-4.914	-5.192	0
MOR268-1	0	0	0	0	0	0	0	-3.63	0
MOR269-1	0	0	0	0	0	0	0	0	0
MOR271-1	-4.14	0	0	0	-3.47	0	0	0	0
MOR272-1	0	-3.558	0	0	-4.181	0	0	0	0
MOR273-1	0	-5.231	0	0	0	0	0	0	0
MOR277-1	0	0	0	0	0	0	0	0	0
MOR30-1	0	0	0	0	0	0	0	0	0
MOR31-1	0	0	0	0	0	0	0	0	0
MOR33-1	0	0	0	0	0	0	0	0	0
MOR37-1	0	0	0	0	0	0	0	0	0
MOR4-1	0	0	0	0	0	0	0	0	0
MOR40-1	0	0	0	0	0	0	0	0	0
MOR41-1	-4.257	0	0	0	-3.68	-4.064	0	0	-3.537
MOR5-1	0	0	0	0	0	0	0	0	0
MOR9-1	0	0	0	0	0	0	0	0	0
OR10J5	0	0	0	0	0	0	0	0	0
OR1A1	-5.765	0	-4.039	-3.082	-3.013	0	0	0	0
OR2C1	0	0	0	0	0	0	0	0	0
OR2J2	0	0	0	-3.416	-3.271	0	-4.16	-4.16	0
OR2M7	0	0	-3.853	0	0	0	0	0	0
OR2W1	-4.657	0	-5.106	-4.365	-4.831	-4.852	-4.63	-5.128	0
OR51E1	0	0	0	0	0	0	0	0	0
OR51E2	0	0	0	0	0	0	0	0	0
OR51L1	0	0	0	0	0	0	0	0	0
OR5P3	-4.846	0	0	0	-2.962	-3.758	0	0	0

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

	2-Coumaranone	2-Heptanone	2-Hexanone	2-Nonanone	2-Octanone	2-Pentanone	23-Hexanedione	3-Heptanone
MOR1-1	-4.138	0	0	0	0	0	0	0
MOR105-1	0	0	0	0	0	0	0	0
MOR106-1	0	0	0	0	0	0	0	0
MOR107-1	0	0	0	0	0	0	0	0
MOR128-2	0	0	0	0	0	0	0	0
MOR129-1	0	0	0	0	0	0	0	0
MOR136-1	0	0	0	0	0	0	0	0
MOR139-1	-3.585	0	0	0	0	0	0	0
MOR140-1	0	0	0	0	0	0	0	0
MOR15-1	0	0	0	0	0	0	0	0
MOR161-1	0	0	0	0	0	0	0	0
MOR162-1	0	0	0	0	0	0	0	0
MOR170-1	0	0	0	0	0	0	0	0
MOR18-1	0	0	0	0	0	0	0	0
MOR180-1	0	0	0	0	0	0	0	0
MOR182-1	0	0	0	0	0	0	0	0
MOR184-1	0	0	0	0	0	0	0	0
MOR185-1	0	0	0	0	0	0	0	0
MOR189-1	0	0	0	0	0	0	0	0
MOR2-1	0	0	0	0	0	0	0	0
MOR203-1	0	-4.76	0	-5.064	-5.023	0	0	-4.099
MOR204-6	0	0	0	0	0	0	0	0
MOR205-1	0	0	0	0	0	0	0	0
MOR207-1	0	0	0	0	0	0	0	0
MOR222-1	0	0	0	0	0	0	0	0
MOR223-1	0	0	0	0	0	0	0	0
MOR23-1	0	0	0	0	0	0	0	0
MOR236-1	0	0	0	0	0	0	0	0
MOR25-1	0	0	0	0	0	0	0	0
MOR250-1	0	0	0	0	0	0	0	0
MOR251-1	0	0	0	0	0	0	0	0
MOR253-1	0	0	0	0	0	0	0	0
MOR256-17	-4.575	0	0	0	0	0	-4.838	0
MOR258-1	-4.268	0	0	0	0	0	0	0
MOR259-1	-3.63	0	0	0	0	0	0	0
MOR260-1	0	0	0	0	0	0	0	0
MOR261-1	0	0	0	0	0	0	0	0
MOR268-1	0	0	0	0	0	0	0	0
MOR269-1	0	0	0	0	0	0	0	0
MOR271-1	0	-4.581	-4.936	0	0	-5.111	-4.824	-5.235
MOR272-1	0	-5.073	-4.251	0	-4.575	0	0	-5.221
MOR273-1	0	0	0	0	0	0	0	0
MOR277-1	0	0	0	0	0	0	0	0
MOR30-1	0	0	0	0	0	0	0	0
MOR31-1	0	0	0	0	0	0	0	0
MOR33-1	0	0	0	0	0	0	0	0
MOR37-1	0	0	0	0	0	0	0	0
MOR4-1	0	0	0	0	0	0	0	0
MOR40-1	0	0	0	0	0	0	0	0
MOR41-1	-3.96	0	0	0	0	0	-5.008	0
MOR5-1	0	0	0	0	0	0	0	0
MOR9-1	0	0	0	0	0	0	0	0
OR10J5	0	0	0	0	0	0	0	0
OR1A1	0	-4.399	0	-3.577	-4.37	0	0	-4.712
OR2C1	0	0	0	0	0	0	0	0
OR2J2	0	0	0	0	0	0	0	0
OR2M7	0	0	0	0	0	0	0	0
OR2W1	0	-5.142	-4.135	-4.701	-4.399	0	-3.363	-4.477
OR51E1	0	0	0	0	0	0	0	0
OR51E2	0	0	0	0	0	0	0	0
OR51L1	0	0	0	0	0	0	0	0
OR5P3	0	0	0	0	0	0	0	0

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

	3-Octanone	34-Hexanedione	4-Chromanone	4-Hydroxycoumarin	Acetophenone	Allyl benzene	Allyl heptanoate
MOR1-1	0	0	0	0	0	0	0
MOR105-1	0	0	0	0	-3.429	-3.332	0
MOR106-1	0	0	0	0	-3.854	-3.921	0
MOR107-1	0	0	0	0	0	0	0
MOR128-2	0	0	0	0	0	0	0
MOR129-1	0	0	-3.785	0	-5.484	0	0
MOR136-1	0	0	0	0	0	0	0
MOR139-1	0	0	-4.028	0	-3.935	0	0
MOR140-1	0	0	0	0	0	0	0
MOR15-1	0	0	0	0	0	0	0
MOR161-1	0	0	0	0	-3.825	0	0
MOR162-1	0	0	-4.225	0	-4.778	0	0
MOR170-1	0	0	-4.209	0	-3.9	0	0
MOR18-1	0	0	0	0	0	0	0
MOR180-1	0	0	0	0	0	0	0
MOR182-1	0	0	0	0	0	0	0
MOR184-1	0	0	0	0	0	0	0
MOR185-1	0	0	-3.833	0	-4.016	0	0
MOR189-1	0	0	-3.664	0	-3.372	0	0
MOR2-1	0	0	0	0	0	0	0
MOR203-1	-4.4	0	0	0	0	0	0
MOR204-6	0	0	0	0	0	0	0
MOR205-1	0	0	0	0	0	0	0
MOR207-1	0	0	-3.724	0	-3.606	0	0
MOR222-1	0	0	-3.616	0	0	0	0
MOR223-1	0	0	0	0	0	0	0
MOR23-1	0	0	0	0	0	0	0
MOR236-1	0	0	0	0	0	0	0
MOR25-1	0	0	0	0	0	0	0
MOR250-1	0	0	0	0	-3.975	0	0
MOR251-1	0	0	0	0	0	0	0
MOR253-1	0	0	0	0	0	0	0
MOR256-17	0	-4.921	0	0	0	-4.146	0
MOR258-1	0	0	0	0	-3.356	0	0
MOR259-1	0	0	0	0	0	0	0
MOR260-1	0	0	0	0	0	0	0
MOR261-1	0	0	0	0	0	0	0
MOR268-1	0	0	0	0	0	0	0
MOR269-1	0	0	0	0	0	0	0
MOR271-1	-4.139	-4.734	-4.047	0	-4.05	0	0
MOR272-1	-4.197	0	-4.043	0	-3.922	0	0
MOR273-1	0	0	-4.201	0	0	0	0
MOR277-1	0	0	-3.415	0	0	0	0
MOR30-1	0	0	0	0	0	0	0
MOR31-1	0	0	0	0	0	0	0
MOR33-1	0	0	0	0	0	0	0
MOR37-1	0	0	0	0	0	0	0
MOR4-1	0	0	0	0	0	0	0
MOR40-1	0	0	0	0	0	0	0
MOR41-1	0	-4.692	-4.747	-4.344	-5.039	0	0
MOR5-1	0	0	0	0	0	0	0
MOR9-1	0	0	0	0	0	0	0
OR10J5	0	0	0	0	0	0	0
OR1A1	-5.291	0	-3.335	0	0	0	-3.323
OR2C1	0	0	0	0	0	0	0
OR2J2	0	0	0	0	0	0	0
OR2M7	0	0	0	0	0	0	0
OR2W1	-5.02	-4.78	-4.041	0	-4.372	0	0
OR51E1	0	0	0	0	0	0	0
OR51E2	0	0	0	0	0	0	0
OR51L1	0	0	0	0	0	0	0
OR5P3	0	0	0	0	-3.898	0	0

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

	Allyl phenylacetate	Amyl hexanoate	Benzene	Benzophenone	Benzyl acetate	Butyl butyryllactate	Butyl formate	Coumarin
MOR1-1	-3.581	0	0	0	0	0	0	0
MOR105-1	0	0	0	0	0	0	0	0
MOR106-1	0	0	0	0	0	0	0	-3.919
MOR107-1	0	0	0	0	0	0	0	0
MOR128-2	0	0	0	0	0	0	0	0
MOR129-1	0	0	0	0	0	0	0	-4.04
MOR136-1	0	0	0	0	0	0	0	0
MOR139-1	-3.625	0	0	0	-3.729	0	0	-3.749
MOR140-1	0	0	0	0	0	0	0	0
MOR15-1	0	0	0	0	0	0	0	0
MOR161-1	0	0	0	0	0	0	0	-3.139
MOR162-1	0	0	0	-3.666	0	0	0	-4.483
MOR170-1	0	0	0	0	0	0	0	-3.969
MOR18-1	0	0	0	0	0	0	0	0
MOR180-1	0	0	0	0	0	0	0	0
MOR182-1	0	0	0	0	0	0	0	0
MOR184-1	0	0	0	0	0	0	0	0
MOR185-1	0	0	0	0	0	0	0	-4.042
MOR189-1	0	0	0	0	0	0	0	-3.215
MOR2-1	-3.253	0	0	0	0	0	0	0
MOR203-1	-3.401	0	0	0	-3.531	0	0	0
MOR204-6	0	0	0	0	0	0	0	-5.099
MOR205-1	0	0	0	0	0	0	0	0
MOR207-1	0	0	0	0	0	0	0	-3.905
MOR222-1	-3.369	0	0	0	0	0	0	0
MOR223-1	-4.178	0	0	0	-3.841	0	0	0
MOR23-1	0	0	0	0	0	0	0	0
MOR236-1	-4.052	0	0	0	0	0	0	0
MOR25-1	0	0	0	0	0	0	0	0
MOR250-1	0	0	0	0	0	0	0	-3.855
MOR251-1	0	0	0	0	0	0	0	0
MOR253-1	0	0	0	0	0	0	0	0
MOR256-17	-3.842	-4.462	0	0	0	0	0	0
MOR258-1	0	0	0	0	0	0	0	-4.296
MOR259-1	0	0	0	-4.442	0	0	0	-3.834
MOR260-1	0	0	0	0	0	0	0	0
MOR261-1	-3.425	0	0	0	-3.352	0	0	0
MOR268-1	-3.434	0	0	0	0	0	0	0
MOR269-1	0	0	0	-3.662	0	0	0	0
MOR271-1	-4.23	0	-4.005	0	-5.379	0	0	0
MOR272-1	-4.824	0	0	0	-4.946	0	0	0
MOR273-1	0	0	0	0	0	0	0	0
MOR277-1	0	0	0	0	0	0	0	0
MOR30-1	0	0	0	0	0	0	0	0
MOR31-1	0	0	0	0	0	0	0	0
MOR33-1	0	0	0	0	0	0	0	0
MOR37-1	0	0	0	0	0	0	0	0
MOR4-1	0	0	0	0	0	0	0	0
MOR40-1	0	0	0	0	0	0	0	0
MOR41-1	0	0	0	0	-3.972	0	0	-4.785
MOR5-1	0	0	0	0	0	0	0	0
MOR9-1	0	0	0	0	0	0	0	0
OR10J5	0	0	0	0	0	0	0	0
OR1A1	-5.119	0	0	-4.008	-3.391	0	0	0
OR2C1	0	0	0	0	0	0	0	0
OR2J2	0	0	0	0	0	0	0	-3.682
OR2M7	0	0	0	0	0	0	0	0
OR2W1	-4.812	0	0	-4.54	-4.786	0	-4.427	-4.065
OR51E1	0	0	0	0	0	-3.473	0	0
OR51E2	0	0	0	0	0	0	0	0
OR51L1	-4.17	0	0	0	0	0	0	0
OR5P3	0	0	0	0	0	0	0	-5.25

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

	Cyclohexanone	Decanal	Decanoic acid	Dihydrojasmone	Ethyl isobutyrate	Geraniol	Heptanal	Heptanoic acid	Hexanal
MOR1-1	0	0	0	0	0	0	0	-3.823	-3.987
MOR105-1	0	0	0	0	0	0	0	0	0
MOR106-1	0	0	0	0	0	0	0	0	0
MOR107-1	0	0	0	0	0	0	0	0	0
MOR128-2	0	0	0	0	0	0	0	0	0
MOR129-1	0	0	0	0	0	0	0	0	0
MOR136-1	-3.065	0	0	0	0	0	0	0	0
MOR139-1	-3.138	0	0	-4.308	0	-3.939	0	0	0
MOR140-1	0	0	0	-3.614	0	0	0	0	0
MOR15-1	0	0	0	0	0	0	0	0	0
MOR161-1	0	0	0	0	0	0	0	0	0
MOR162-1	0	0	0	0	0	0	0	0	0
MOR170-1	0	0	0	0	0	0	0	0	0
MOR18-1	0	0	0	0	0	0	0	0	0
MOR180-1	0	0	0	0	0	0	0	0	0
MOR182-1	0	0	0	0	0	0	0	0	0
MOR184-1	0	0	0	0	0	0	0	0	0
MOR185-1	-3.594	0	0	0	0	0	0	0	0
MOR189-1	0	0	0	-3.945	0	0	0	0	0
MOR2-1	0	0	0	0	0	0	0	0	0
MOR203-1	0	0	-3.751	0	0	-3.622	0	0	0
MOR204-6	0	0	0	0	0	0	0	0	0
MOR205-1	0	0	0	-4.699	0	0	0	0	0
MOR207-1	0	0	0	0	0	0	0	0	0
MOR222-1	0	0	0	0	0	0	0	0	0
MOR223-1	0	0	0	0	0	0	0	0	0
MOR23-1	0	0	0	0	0	0	0	-4.856	0
MOR236-1	0	0	0	0	0	-3.843	0	0	0
MOR25-1	0	0	-4.194	0	0	0	0	0	0
MOR250-1	0	0	0	0	0	0	0	0	0
MOR251-1	-3.193	0	0	0	0	0	0	0	0
MOR253-1	-3.219	0	0	0	0	0	0	0	0
MOR256-17	-4.1	0	-4.627	0	0	0	0	0	0
MOR258-1	-3.824	0	0	0	0	0	0	0	0
MOR259-1	0	0	0	0	0	0	0	0	0
MOR260-1	0	0	-3.542	0	0	0	0	0	0
MOR261-1	0	0	0	0	0	0	0	0	0
MOR268-1	0	0	0	0	0	-3.897	0	0	0
MOR269-1	0	0	0	0	0	0	0	0	0
MOR271-1	-3.463	0	0	-4.126	-4.077	0	0	0	-3.322
MOR272-1	-3.254	0	0	-4.447	-5.25	0	0	0	0
MOR273-1	-3.208	0	0	-4.441	-5.761	0	0	0	0
MOR277-1	-3.566	0	0	0	0	0	0	0	0
MOR30-1	0	-4.033	-4.987	0	0	0	0	-3.575	0
MOR31-1	0	0	0	0	0	0	0	-5.2	0
MOR33-1	0	0	-4.487	0	0	0	0	-4.148	0
MOR37-1	0	-3.477	-4.323	0	0	0	0	0	0
MOR4-1	0	0	0	0	0	0	0	0	-3.231
MOR40-1	0	0	-4.121	0	0	0	0	0	0
MOR41-1	-3.456	0	0	-3.766	0	0	0	0	0
MOR5-1	0	0	-3.749	0	0	0	0	-3.583	0
MOR9-1	0	0	0	0	0	0	0	0	0
OR10J5	0	0	0	0	0	0	0	0	0
OR1A1	0	0	0	-7.242	0	-3.467	0	0	0
OR2C1	0	0	0	0	0	0	0	0	0
OR2J2	0	0	0	0	0	0	0	0	0
OR2M7	0	0	0	0	0	-3.203	0	0	0
OR2W1	0	0	-3.756	-4.246	0	-4.736	-4.056	0	-5.102
OR51E1	0	0	0	0	0	0	0	0	0
OR51E2	0	0	0	0	0	0	0	0	0
OR51L1	0	0	0	0	0	0	0	0	0
OR5P3	0	0	0	0	0	0	0	0	0

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

	Hexanoic acid	Hexyl acetate	Lyral	Nonanal	Nonanethiol	Nonanoic acid	Octanal	Octanethiol	Octanoic acid
MOR1-1	-4.625	0	0	0	0	0	0	0	0
MOR105-1	0	0	0	0	0	0	0	0	0
MOR106-1	0	0	0	0	0	0	0	0	0
MOR107-1	0	0	0	0	0	0	0	0	0
MOR128-2	0	0	0	0	0	0	0	0	0
MOR129-1	0	0	0	0	0	0	0	0	0
MOR136-1	0	0	0	0	0	0	0	0	0
MOR139-1	0	0	0	0	0	0	0	0	0
MOR140-1	0	0	0	0	0	0	0	0	0
MOR15-1	0	0	0	0	0	0	0	0	0
MOR161-1	0	0	0	0	0	0	0	0	0
MOR162-1	0	0	0	0	0	0	0	0	0
MOR170-1	0	0	0	0	0	0	0	0	0
MOR18-1	0	0	0	0	0	-4.077	0	0	0
MOR180-1	0	0	0	0	0	0	0	0	0
MOR182-1	0	0	0	0	0	0	0	0	0
MOR184-1	0	0	0	0	0	0	0	0	0
MOR185-1	0	0	0	0	0	0	0	0	0
MOR189-1	0	0	0	0	0	0	0	0	0
MOR2-1	0	0	0	0	0	0	0	0	0
MOR203-1	0	0	0	0	-3.528	-3.476	0	-3.356	0
MOR204-6	0	0	0	0	0	0	0	0	0
MOR205-1	0	0	0	0	0	0	0	0	0
MOR207-1	0	0	0	0	0	0	0	0	0
MOR222-1	0	0	0	0	0	0	0	0	0
MOR223-1	0	0	0	0	0	0	0	0	0
MOR23-1	0	0	0	0	0	0	0	0	-5.083
MOR236-1	0	0	0	0	0	0	0	0	0
MOR25-1	0	0	0	0	0	0	0	0	-3.689
MOR250-1	0	0	0	0	0	0	0	0	0
MOR251-1	0	0	0	0	0	0	0	0	0
MOR253-1	0	0	0	0	0	0	0	0	0
MOR256-17	0	0	-4.255	0	0	-4.694	0	-4.388	-4.41
MOR258-1	0	0	0	0	0	0	0	0	0
MOR259-1	0	0	0	0	0	0	0	0	0
MOR260-1	0	0	0	0	-4.468	-4.106	0	0	0
MOR261-1	0	0	0	0	-3.376	0	0	0	0
MOR268-1	0	0	0	0	-3.589	0	0	0	0
MOR269-1	0	0	0	0	0	0	0	0	0
MOR271-1	0	0	0	0	0	0	0	0	0
MOR272-1	0	0	0	0	0	0	0	0	0
MOR273-1	0	0	0	0	0	0	0	0	0
MOR277-1	0	0	0	0	0	0	0	0	0
MOR30-1	0	0	0	-3.914	0	-4.396	0	0	-3.68
MOR31-1	0	0	0	0	0	0	0	0	0
MOR33-1	0	0	0	-3.234	0	-4.606	0	0	-4.212
MOR37-1	0	0	0	-3.295	0	-3.9	0	0	0
MOR4-1	0	0	0	0	0	0	0	0	0
MOR40-1	0	0	0	-3.194	0	-4.128	0	0	-3.617
MOR41-1	0	0	0	0	0	0	0	0	0
MOR5-1	0	0	0	0	0	-4.029	0	0	-3.711
MOR9-1	0	0	0	0	0	0	0	0	0
OR10J5	0	0	-3.489	0	0	0	0	0	0
OR1A1	0	0	0	0	-3.243	0	0	-3.226	0
OR2C1	0	0	0	0	-3.893	0	0	-4.051	0
OR2J2	0	0	0	0	0	0	0	0	0
OR2M7	0	0	0	0	0	0	0	0	0
OR2W1	0	-4.863	0	-3.598	-4.065	-3.723	-4.361	-4.033	-4.847
OR51E1	0	0	0	0	0	-3.609	0	0	0
OR51E2	0	0	0	0	0	0	0	0	0
OR51L1	-3.834	0	0	0	0	0	0	0	0
OR5P3	0	0	0	0	0	0	0	0	0

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

	Pentanoic acid	Phenyl acetate	Prenyl acetate	Propionic acid	Vanillic acid	g-Caprolactone
MOR1-1	-4.613	0	0	0	0	0
MOR105-1	0	0	0	0	0	0
MOR106-1	0	-3.874	0	0	0	0
MOR107-1	0	0	0	0	0	0
MOR128-2	0	0	0	0	0	0
MOR129-1	0	0	0	0	0	0
MOR136-1	0	0	0	0	0	0
MOR139-1	0	-3.421	-3.385	0	0	0
MOR140-1	0	0	0	0	0	0
MOR15-1	0	0	0	0	-3.587	0
MOR161-1	0	0	0	0	0	0
MOR162-1	0	0	0	0	0	0
MOR170-1	0	0	0	0	0	0
MOR18-1	0	0	0	0	0	0
MOR180-1	0	0	-3.18	0	0	0
MOR182-1	0	0	0	0	0	0
MOR184-1	0	0	0	0	0	0
MOR185-1	0	0	0	0	0	-3.185
MOR189-1	0	0	0	0	0	0
MOR2-1	0	0	0	0	0	0
MOR203-1	0	-3.039	-3.907	0	0	-4.001
MOR204-6	0	0	0	0	0	0
MOR205-1	0	0	0	0	0	0
MOR207-1	0	0	0	0	0	0
MOR222-1	0	0	0	0	0	0
MOR223-1	0	-3.487	0	0	0	0
MOR23-1	0	0	0	0	0	0
MOR236-1	0	0	0	0	0	0
MOR25-1	0	0	0	0	0	0
MOR250-1	0	-3.545	0	0	0	0
MOR251-1	0	0	0	0	0	0
MOR253-1	0	0	0	0	0	0
MOR256-17	0	0	0	0	0	0
MOR258-1	0	0	-3.099	0	0	-3.38
MOR259-1	0	0	0	0	0	0
MOR260-1	0	0	0	0	0	0
MOR261-1	0	0	0	0	0	0
MOR268-1	0	0	0	0	0	0
MOR269-1	0	0	0	0	0	0
MOR271-1	0	0	-5.033	0	0	-3.18
MOR272-1	0	0	-5.098	0	0	-3.272
MOR273-1	0	0	0	0	0	0
MOR277-1	0	0	0	0	0	0
MOR30-1	0	0	0	0	0	0
MOR31-1	0	0	0	0	0	0
MOR33-1	0	0	0	0	0	0
MOR37-1	0	0	0	0	0	0
MOR4-1	0	0	0	0	0	0
MOR40-1	0	0	0	0	0	0
MOR41-1	0	-4.143	0	0	0	0
MOR5-1	0	0	0	0	0	0
MOR9-1	0	0	0	0	-6.334	0
OR10J5	0	0	0	0	0	0
OR1A1	0	0	0	0	0	0
OR2C1	0	0	0	0	0	0
OR2J2	0	0	0	0	0	0
OR2M7	0	0	0	0	0	0
OR2W1	0	0	-4.071	0	0	0
OR51E1	0	0	0	0	0	0
OR51E2	0	0	0	-3.963	0	0
OR51L1	0	0	0	0	0	0
OR5P3	0	0	0	0	0	0

Table S3. The numerical EC50 values (log M) displayed in Fig. 1

100-06-1	102-13-6	104-53-0	10588-15-5	108-22-5	110-86-1	112-43-6	119-65-3
100-09-4	102-16-9	104-54-1	105-89-5	108-39-4	110-89-4	112-44-7	1197-01-9
10022-28-3	102-17-0	104-55-2	105-90-8	108-47-4	110-93-0	112-45-8	119-84-6
10024-56-3	102-19-2	104-57-4	105-91-9	108-48-5	110-98-5	1125-21-9	1200-67-5
10024-57-4	102-20-5	104-61-0	105-95-3	108-50-9	111-11-5	112-53-8	120-11-6
10024-64-3	102-22-7	10461-98-0	10599-70-9	108-64-5	111-12-6	112-54-9	120-14-9
10024-97-2	102369-06-2	104-62-1	106-02-5	108-82-7	111-13-7	1125-88-8	120-24-1
1002-84-2	102-69-2	104-64-3	106-18-3	108-83-8	111-14-8	112-63-0	120-45-6
1003-04-9	102-76-1	104-65-4	106-21-8	108-94-1	111-26-2	112-66-3	120-50-3
10031-71-7	103-05-9	104-67-6	106-22-9	108-95-2	111-27-3	112-80-1	120-51-4
10031-82-0	103-07-1	104691-41-0	106-23-0	108-98-5	111-28-4	1128-08-1	1205-17-0
10031-86-4	103-13-9	10471-14-4	106-24-1	109-05-7	111-30-8	112-92-5	120-57-0
10031-87-5	10321-71-8	10471-96-2	106-25-2	109-08-0	1113-13-9	1129-47-1	120-72-9
10031-88-6	103-25-3	104-76-7	106-26-3	109-15-9	111-31-9	1131-62-0	120-92-3
10031-90-0	103-26-4	10482-55-0	106-27-4	109-19-3	1113-21-9	113486-29-6	1209-61-6
10031-92-2	103-28-6	10482-56-1	106-28-5	109-20-6	1113-60-6	113889-23-9	121-00-6
10031-93-3	103-36-6	10482-77-6	106-29-6	109-21-7	111-47-7	1139-30-6	1211-29-6
10031-96-6	103-37-7	10482-79-8	106-30-9	109-25-1	1115-11-3	1142-85-4	121251-67-0
10032-00-5	103-38-8	10484-09-0	106-32-1	109-29-5	111-66-0	1153-51-1	121251-68-1
10032-02-7	10339-55-6	10484-36-3	106-33-2	109-42-2	111-70-6	115-95-7	121-32-4
10032-05-0	10340-23-5	10486-14-3	106-35-4	109-52-4	111-71-7	115-99-1	121-33-5
10032-08-3	103-41-3	10486-19-8	106-36-5	109537-55-5	1117-55-1	116-02-9	121-34-6
10032-13-0	103-45-7	104-87-0	106-44-5	109-60-4	1117-61-9	116-26-7	121-39-1
10032-15-2	103-48-0	104-90-5	106-65-0	109-73-9	111-79-5	116-53-0	121-44-8
10039-39-1	103-50-4	104-93-8	106-68-3	109-79-5	111-80-8	117013-33-9	121-79-9
100-42-5	103-52-6	104986-28-9	106-70-7	109-80-8	111-81-9	117933-89-8	121-98-2
100-51-6	103-53-7	105-01-1	106-72-9	109-94-4	111-82-0	117-98-6	122-00-9
100-52-7	103-54-8	105-13-5	106-73-0	109-95-5	1118-27-0	1184-78-7	122-03-2
100-53-8	103-56-0	10519-11-6	107-03-9	109-97-7	1118-39-4	118-55-8	1222-05-5
10058-43-2	103-58-2	10519-33-2	107-10-8	110-15-6	111-87-5	118-58-1	122-40-7
1006-27-5	103-59-3	105-21-5	1072-83-9	110-17-8	111-90-0	118-60-5	122-43-0
100-66-3	103-60-6	10521-91-2	1073-11-6	110-19-0	1119-06-8	118-61-6	122-44-1
100-68-5	103-61-7	10522-18-6	1073-26-3	110-27-0	1119-44-4	118-71-8	122-45-2
10072-05-6	103-64-0	105-37-3	1073-29-6	11031-45-1	112-05-0	118-72-9	122-48-5
100-86-7	103694-68-4	105-43-1	107-35-7	110-38-3	112-06-1	1188-02-9	122-57-6
10094-34-5	103-82-2	10544-63-5	107-41-5	110-39-4	112-12-9	1189-09-9	122-59-8
10094-36-7	103-93-5	105463-44-3	107-43-7	110-40-7	112-14-1	118-93-4	12262-03-2
10094-41-4	103-95-7	105-53-3	1076-56-8	110-41-8	112-17-4	1191-16-8	122-63-4
101-39-3	10402-33-2	105-54-4	107-74-4	110-42-9	112-19-6	1191-43-1	122-67-8
101-41-7	10402-47-8	105-57-7	107-75-5	110-43-0	112-23-2	1191-62-4	122-68-9
101-48-4	10402-48-9	105-60-2	107-85-7	110-44-1	1122-54-9	1192-58-1	122-69-0
101-49-5	10402-52-5	105-66-8	107-86-8	110-45-2	1122-62-9	1192-62-7	122-70-3
10152-76-8	104-09-6	105-68-0	107-87-9	110458-85-0	112-30-1	1193-11-9	122-72-5
101-81-5	10414-68-3	105-79-3	107898-54-4	11050-62-7	112-31-2	1193-18-6	122-73-6
101-84-8	10415-87-9	10580-25-3	1079-01-2	110-58-7	112-32-3	119-36-8	122-74-7
101-85-9	10415-88-0	105-82-8	107-92-6	110-62-3	112-37-8	1193-79-9	122-78-1
101-86-0	104-20-1	105-85-1	107-95-9	110-66-7	1123-85-9	1195-32-0	122-79-2
101-94-0	104-21-2	105-86-2	1080-12-2	110-74-7	112-38-9	119-53-9	122-84-9
101-97-3	104-45-0	105-87-3	108-10-1	110-81-6	1124-11-4	1196-01-6	122-91-8
102-04-5	104-50-7	10588-10-0	108-21-4	110-85-0	112-42-5	119-61-9	122-97-4

Table S4. CAS registry numbers for 2,683 odorants used to estimate the size of odorant space. Structure files were obtained from (http://www.thegoodscentscompany.com).

122-99-6	13109-70-1	135-79-5	140-39-6	14667-55-1	1576-95-0	1731-84-6	18492-65-4
123-07-9	13112-65-7	13623-11-5	1405-92-1	1470-50-4	1577-18-0	1731-86-8	18640-74-9
123-08-0	13162-46-4	1365-19-1	140-67-0	147159-49-7	1577-19-1	1733-25-1	1866-31-5
123-11-5	13171-00-1	136-60-7	14073-97-3	14735-72-9	15986-80-8	17369-59-4	18679-18-0
123-15-9	131766-73-9	13678-58-5	140-88-5	14765-30-1	1599-47-9	17369-60-7	1871-67-6
123-19-3	131812-67-4	13678-59-6	141-06-0	147-85-3	1599-49-1	17369-61-8	1875-89-4
123-25-1	13184-86-6	13678-60-9	141-09-3	14812-03-4	1604-28-0	17373-84-1	18776-92-6
123-29-5	1319-88-6	13678-67-6	14109-72-9	14901-07-6	1608-72-6	17373-89-6	1878-18-8
123-32-0	1321-30-8	13678-68-7	141-10-6	149982-46-7	16128-68-0	17488-65-2	18794-77-9
123-35-3	13215-88-8	13679-46-4	141-11-7	150-30-1	1617-23-8	17511-60-3	18794-84-8
123-38-6	1321-89-7	13679-61-3	141-12-8	150436-68-3	1617-40-9	1754-62-7	18824-63-0
123-51-3	1322-17-4	13679-70-4	141-13-9	1504-55-8	1618-26-4	17587-33-6	18829-55-5
123-54-6	1322-34-5	13679-85-1	141-14-0	1504-74-1	16251-77-7	1759-28-0	18829-56-6
123-63-7	1322-58-3	13679-86-2	141-15-1	1504-75-2	1629-58-9	17597-95-4	18836-52-7
123-66-0	1323-00-8	136954-20-6	141-16-2	1506-02-1	1632-73-1	17619-36-2	1883-78-9
123-68-2	13246-52-1	136954-21-7	141-25-3	150-60-7	16356-11-9	17699-14-8	1885-38-7
123-72-8	13254-34-7	136954-22-8	14129-48-7	150-78-7	1639-09-4	1775-43-5	188570-78-7
123-75-1	13257-44-8	137-00-8	14159-61-6	150-84-5	16409-43-1	1786-08-9	188590-62-7
123-76-2	133-18-6	137-03-1	14173-25-2	150-86-7	16409-45-3	17909-77-2	18871-14-2
123-86-4	1331-92-6	137-06-4	141-78-6	151-05-3	16409-46-4	1797-74-6	1888-90-0
123-96-6	13327-56-5	13706-86-0	141-79-7	151-10-0	16429-21-3	180031-78-1	18999-28-5
124-04-9	1333-58-0	13708-12-8	141-92-4	15111-96-3	1646-26-0	18031-40-8	19009-56-4
124-06-1	133-37-9	137-32-6	141-97-9	15111-97-4	16491-24-0	18060-79-2	1901-26-4
124-07-2	13341-72-5	13794-15-5	142-19-8	151-19-9	16491-25-1	18096-62-3	1901-38-8
124-10-7	1334-78-7	13794-73-5	142-60-9	1516-17-2	16491-36-4	18114-49-3	19089-92-0
124-12-9	1334-82-3	13816-33-6	142-62-1	15186-51-3	16491-54-6	181258-87-7	19139-31-2
124-13-0	13351-61-6	138-22-7	142-83-6	15323-35-0	16493-80-4	18127-01-0	19141-40-3
124-19-6	1335-44-0	138-23-8	142-91-6	1534-08-3	1653-30-1	18138-03-9	19224-26-1
124-25-4	1335-46-2	13828-37-0	142-92-7	15356-74-8	16587-71-6	18138-04-0	19269-28-4
124-76-5	1335-66-6	13851-11-1	143-07-7	15373-31-6	16630-52-7	18138-05-1	19317-11-4
125109-85-5	13360-64-0	13877-91-3	143-08-8	154171-76-3	16630-55-0	18172-67-3	19322-27-1
125-12-2	1337-83-3	13877-93-5	14309-57-0	154171-77-4	16630-60-7	18189-02-1	19342-01-9
125352-06-9	134123-93-6	138-86-3	143-13-5	1551-44-6	16630-66-3	18189-07-6	1946-00-5
126-64-7	13419-69-7	138-87-4	143-14-6	156-06-9	166432-52-6	182699-77-0	19487-61-7
126-91-0	134-20-3	13894-63-8	143-28-2	1565-76-0	1669-44-9	18277-27-5	196109-18-9
127-17-3	134-28-1	13925-00-3	14360-50-0	1565-81-7	1670-47-9	18318-83-7	1963-36-6
127-41-3	13442-90-5	13925-03-6	14371-10-9	15679-12-6	1679-07-8	18368-91-7	1968-40-7
127-42-4	134454-31-2	13925-05-8	14374-92-6	15679-13-7	169054-69-7	18383-49-8	19700-21-1
127-43-5	13466-78-9	13925-06-9	1438-91-1	15679-19-3	16930-93-1	18402-83-0	19788-49-9
127-51-5	134769-33-8	13925-07-0	1438-94-4	1569-60-4	16930-96-4	18409-17-1	19819-98-8
127-91-3	13477-62-8	139-45-7	14400-67-0	15706-73-7	16939-73-4	18409-18-2	198404-98-7
128119-70-0	13481-87-3	139504-68-0	14436-32-9	15707-23-0	1706-12-3	18409-20-6	19870-74-7
128-37-0	13491-79-7	13952-84-6	144-39-8	15707-24-1	1708-34-5	18409-21-7	19872-52-7
128-50-7	13494-06-9	139-70-8	14481-52-8	1575-74-2	1708-35-6	18433-93-7	19902-08-0
128-51-8	13494-07-0	13991-37-2	14481-55-1	15760-18-6	1708-81-2	18436-37-8	20053-88-7
13002-09-0	134-96-3	140-10-3	145-39-1	15764-16-6	17092-92-1	18479-51-1	20125-81-9
13019-20-0	135-02-4	140-11-4	14576-08-0	1576-77-8	17102-64-6	18479-54-4	20125-84-2
13019-22-2	13532-18-8	140-25-0	14595-54-1	1576-78-9	1725-01-5	18479-57-7	2021-28-5
13074-63-0	13552-96-0	140-26-1	1460-34-0	1576-85-8	17283-81-7	18479-58-8	202188-43-0
13074-65-2	13567-39-0	140-27-2	14620-52-1	1576-87-0	1728-46-7	18485-38-6	20279-51-0

Table S4. CAS registry numbers for 2,683 odorants used to estimate the size of odorant space. Structure files were obtained from (http://www.thegoodscentscompany.com).

20286-45-7	21662-13-5	2306-78-7	2439-44-3	25680-57-3	288-47-1	3149-28-8	3386-97-8
20298-69-5	21662-16-8	2306-88-9	24401-36-3	25680-58-4	28897-58-7	31499-71-5	33885-51-7
20333-39-5	21722-83-8	2306-91-4	196780	2568-25-4	28940-11-6	31499-72-6	543088
2035-99-6	2173-56-0	2307-10-0	2444-46-4	25773-40-4	29021-37-2	31501-11-8	3391-83-1
2040-10-0	2173-57-1	2308-18-1	2444-49-7	2623-23-6	290-37-9	31502-14-4	3391-86-4
20407-84-5	2177-77-7	2311-46-8	2445-67-2	2628-17-3	29214-60-6	31539-84-1	33922-73-5
2044-73-7	2179-57-9	2315-68-6	2445-72-9	26303-90-2	29350-73-0	3155-71-3	34047-39-7
2046-17-5	2179-58-0	23267-57-4	2445-76-3	2630-39-9	29414-47-9	31704-80-0	3407-42-9
20474-93-5	2179-59-1	23328-62-3	2445-77-4	2639-63-6	29460-90-0	3188-00-9	34131-98-1
20489-53-6	2179-60-4	23333-91-7	2445-78-5	2639-68-1	29548-14-9	31906-04-4	34135-85-8
2049-96-9	21834-92-4	233665-96-8	2463-53-8	26446-31-1	29548-30-9	3194-17-0	34291-99-1
53329	21835-01-8	2344-70-9	24653-75-6	26446-32-2	29606-79-9	3208-16-0	34300-94-2
2050-08-0	2186-92-7	2345-24-6	24680-50-0	26553-47-9	29725-66-4	3208-40-0	34322-09-3
53570	21948-70-9	2345-26-8	24683-00-9	26643-91-4	29759-11-3	3209-13-0	34365-79-2
2050-87-5	21963-26-8	2345-28-0	24691-15-4	2679-87-0	29811-50-5	32210-23-4	34413-35-9
2051-78-7	21964-44-3	162721	24717-85-9	26912-64-1	2983-36-0	32214-91-8	34451-19-9
2051-96-9	2198-61-0	2349-13-5	24720-09-0	27039-84-5	2983-37-1	32388-55-9	34495-71-1
2052-14-4	22014-48-8	23495-12-7	24817-51-4	2705-87-5	2983-38-2	3239-35-8	3452-97-9
2052-15-5	22029-76-1	2351-90-8	24851-98-7	297890	2986-54-1	3239-37-0	34545-88-5
20582-85-8	22030-19-9	23550-40-5	2497-18-9	2721-22-4	29895-73-6	488211	3460-44-4
20662-84-4	22047-25-2	2363-88-4	2497-21-4	27538-09-6	29896-45-5	3240-29-7	34686-67-4
20665-85-4	22094-00-4	23696-85-7	2500-83-6	2756-56-1	29926-41-8	3249-68-1	34686-71-0
20680-10-8	22104-80-9	23726-91-2	25013-16-5	2758-18-1	29926-42-9	32659-21-5	34687-46-2
20691-52-5	22104-81-0	23747-43-5	2511-00-4	27593-23-3	3008-43-3	326-61-4	34764-02-8
20777-49-5	2216-45-7	23747-45-7	25152-84-5	27606-09-3	30086-02-3	32665-23-9	3487-99-8
20780-48-7	2216-51-5	23747-48-0	25152-85-6	27625-35-0	30100-15-3	3268-49-3	3488-00-4
20780-49-8	2216-52-6	23787-80-6	2520-60-7	27743-70-0	3016-19-1	32736-91-7	3489-28-9
20834-59-7	2216-81-1	23787-90-8	25225-08-5	27817-67-0	30168-23-1	32737-14-7	34902-57-3
2084-18-6	2217-33-6	23811-08-7	25225-10-9	27829-72-7	3025-30-7	32764-98-0	350-03-8
2084-19-7	117731	23832-18-0	25265-71-8	2785-87-7	302-72-7	32803-39-7	35044-57-6
20920-83-6	2235-83-8	2396-77-2	25279-09-8	2785-89-9	30310-41-9	328-50-7	35044-58-7
2100-17-6	22418-66-2	2396-78-3	228916	27939-60-2	3033-23-6	3289-28-9	35044-59-8
21016-46-6	2244-16-8	2396-83-0	25304-14-7	28043-10-9	30361-28-5	3293-47-8	35087-49-1
21063-71-8	22457-23-4	2396-84-1	25312-34-9	28069-72-9	30361-29-6	32974-92-8	3508-98-3
2109-22-0	2253-73-8	2403-58-9	25409-08-9	28069-74-1	30390-50-2	3301-90-4	35154-45-1
2110-18-1	129176	24048-14-4	25415-62-7	28217-92-7	30408-61-8	3301-94-8	35158-25-9
2111-75-3	22629-49-8	2408-20-0	25415-67-2	28219-60-5	30418-89-4	33046-81-0	35178-55-3
21129-27-1	22694-96-8	2408-37-9	25435-63-6	28219-61-6	30453-31-7	33049-93-3	35205-76-6
211323-05-6	2270-60-2	2412-80-8	25485-88-5	28231-03-0	3054-92-0	3338-55-4	35206-51-0
2114-33-2	227456-27-1	24168-70-5	2548-87-0	2835-39-4	30640-46-1	334-48-5	35234-22-1
21145-77-7	227456-28-2	2416-94-6	2550-11-0	28371-99-5	30673-38-2	334-49-6	35250-53-4
21188-58-9	22771-44-4	24237-00-1	2550-26-7	2847-30-5	30772-79-3	33467-73-1	352-93-2
2120-70-9	2277-16-9	24295-03-2	2550-40-5	28588-73-0	30895-79-5	33467-74-2	35448-31-8
21280-29-5	2277-19-2	2432-51-1	2550-52-9	28588-74-1	30897-75-7	33467-76-4	35472-56-1
2142-94-1	2278-53-7	2432-77-1	25524-95-2	28588-75-2	3100-36-5	33467-79-7	3549-23-3
2153-26-6	22810-10-2	2432-91-9	238419	28631-86-9	31375-17-4	33522-69-9	3558-60-9
2153-28-8	22882-89-9	24330-52-7	25564-22-1	28645-51-4	313973-37-4	33662-58-7	3564-98-5
21593-77-1	2294-76-0	2435-16-7	240883	28664-35-9	31416-78-1	33673-62-0	609379
21661-97-2	146589	2437-25-4	25634-93-9	2882-20-4	3142-66-3	33673-65-3	3581-91-7
21662-09-9	2305-25-1	2437-95-8	2565-82-4	28839-13-6	3142-72-1	33704-61-9	3583-00-4

Table S4. CAS registry numbers for 2,683 odorants used to estimate the size of odorant space. Structure files were obtained from (http://www.thegoodscentscompany.com).

35852-41-6	38325-25-6	40878-72-6	4360-47-8	472-97-9	50-21-5	1205978	538-86-3
35852-46-1	38363-23-4	40910-49-4	4361-23-3	473-15-4	502-47-6	52210-18-1	53889-39-7
35854-86-5	707902	40923-64-6	4362-22-5	4732-13-2	502-61-4	5240-32-4	5392-40-5
35926-04-6	38433-74-8	40942-73-2	898649	473-67-6	502-69-2	52474-60-9	539-30-0
3600-24-6	38446-21-8	4112-89-4	4395-92-0	4740-79-8	502-72-7	52517-67-6	5396-89-4
622683	38462-22-5	41199-19-3	4410-99-5	1038568	50373-36-9	52557-97-8	539-82-2
3613-30-7	38462-23-6	41239-48-9	4411-89-6	4748-78-1	503-74-2	5271-38-5	539-88-8
36219-73-5	3848-24-6	41270-80-8	4426-79-3	475-03-6	505-10-2	527-60-6	539-90-2
36267-71-7	3856-25-5	41453-56-9	4430-31-3	475-20-7	505-29-3	52789-73-8	540-07-8
36306-87-3	38713-41-6	41496-43-9	4430-36-8	4798-44-1	505-32-8	5287-45-6	540-18-1
36431-72-8	38917-61-2	41519-18-0	4430-39-1	4798-61-2	505-57-7	52-90-4	540-42-1
36438-54-7	38917-62-3	41519-23-7	4430-42-6	4819-67-4	505-79-3	5292-21-7	5405-41-4
3658-77-3	39026-94-3	41547-22-2	4433-36-7	4826-62-4	50607-64-2	53018-24-9	5405-58-3
3658-79-5	39067-39-5	41653-97-8	4437-20-1	4861-58-9	50623-57-9	53046-97-2	1279415
3658-80-8	39067-80-6	4166-20-5	4437-22-3	4861-85-2	50626-02-3	53053-51-3	540-63-6
3658-93-3	3913-71-1	41724-19-0	4437-51-8	4864-61-3	50-69-1	531-26-0	5406-58-6
3661-77-6	3913-80-2	4180-23-8	443-79-8	488-10-8	50-70-4	531-59-9	54082-68-7
36653-82-4	3913-81-3	41816-03-9	4440-65-7	4883-60-7	507-09-5	5320-75-2	54089-83-7
36701-01-6	3915-83-1	41820-22-8	4442-79-9	489-40-7	50746-10-6	53243-59-7	541-31-1
36789-59-0	39212-23-2	41847-88-5	4455-13-4	489-86-1	507-70-0	53243-60-0	541-35-5
36806-46-9	39251-86-0	41890-92-0	4466-24-4	490-03-9	5077-67-8	53263-58-4	5413-60-5
3681-71-8	39251-88-2	42075-45-6	4493-42-9	4906-24-5	50816-18-7	5328-37-0	541-47-9
3681-82-1	39252-02-3	42078-65-9	4500-58-7	491-04-3	50-81-7	5331-14-6	541-58-2
3682-42-6	39252-03-4	4208-49-5	4501-58-0	491-07-6	5090-41-5	5331-32-8	5418-86-0
37160-77-3	39255-32-8	4208-57-5	45019-28-1	491-09-8	51100-54-0	533-18-6	541-91-3
37172-02-4	3943-74-6	4230-97-1	4532-64-3	4927-39-3	51115-67-4	53338-05-9	1284897
37172-05-7	39481-28-2	42348-12-9	4536-23-6	4938-52-7	51154-96-2	53398-78-0	5421-17-0
37172-53-5	39711-79-0	42370-07-0	4573-50-6	1109189	512-13-0	53398-80-4	5421-27-2
3720-16-9	39736-25-9	42436-07-7	4586-22-5	4948-28-1	5132-75-2	53398-83-7	5422-34-4
3724-61-6	39741-41-8	42474-44-2	459-80-3	494-90-6	513-44-0	53398-85-9	542-46-1
3724-65-0	39748-49-7	4253-89-8	4602-84-0	495-40-9	51352-68-2	53398-86-0	542-55-2
3738-00-9	39770-05-3	42604-12-6	4606-15-9	495-62-5	5137-52-0	53398-87-1	5426-78-8
37514-30-0	39872-57-6	426218-78-2	992463	495-76-1	513-86-0	53399-81-8	542-85-8
37526-88-8	39900-38-4	4265-16-1	995835	49576-57-0	5146-66-7	53405-97-3	54300-08-2
3760-11-0	39924-52-2	4265-97-8	4630-82-4	496-77-5	515-00-4	534-15-6	54300-09-3
37609-25-9	40010-99-9	42822-86-6	4634-89-3	497-03-0	51532-26-4	534-22-5	543-39-5
37617-03-1	40018-26-6	42824-62-4	4643-25-8	497-23-4	51534-66-8	53448-07-0	54340-90-8
37674-63-8	40188-41-8	42919-64-2	4643-27-0	49776-81-0	51566-62-2	53475-15-3	5434-57-1
37677-14-8	40203-73-4	43039-98-1	464-43-7	498-00-0	515-69-5	53488-14-5	543-49-7
3777-69-3	4023-65-8	43040-01-3	464-45-9	498-02-2	51595-91-6	5349-62-2	5435-64-3
3777-71-7	40348-72-9	431-03-8	464-49-3	498-81-7	516-06-3	53498-32-1	5436-21-5
3782-00-1	40527-42-2	4312-99-6	465-24-7	499-12-7	51608-18-5	5362-56-1	54393-36-1
37837-44-8	40654-82-8	879933	4674-50-4	499-44-5	51652-47-2	536-50-5	54411-06-2
37887-04-0	40716-66-3	43219-68-7	4695-62-9	499-54-7	5166-53-0	536-59-4	5442-00-2
3796-70-1	4077-47-8	432-25-7	469-61-4	499-70-7	51-67-2	536-60-7	544-40-1
37973-51-6	40785-62-4	894025	470-67-7	499-75-2	51755-66-9	536-78-7	54440-17-4
38205-60-6	40789-98-8	4351-54-6	4707-47-5	500-02-7	51755-83-0	53767-93-4	544-63-8
38205-64-0	40790-04-3	4359-31-3	470-82-6	5009-32-5	51755-85-2	53833-30-0	54464-57-2
38223-29-9	40853-53-0	4359-47-1	472-66-2	501-52-0	5182-36-5	53833-32-2	54464-59-4
38285-49-3	40853-56-3	4359-57-3	4728-82-9	501-92-8	1205849	538-65-8	54484-73-0

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5451-52-5	55764-28-8	579-07-7	591-12-8	60788-25-2	623-19-8	629-63-0	65113-95-3
5451-80-9	5577-44-6	57934-97-1	591-24-2	607-90-9	623-21-2	629-70-9	65113-99-7
5451-88-7	5579-78-2	1420859	591-49-1	60-82-2	623-22-3	6297-41-2	1683469
5451-95-6	5595-79-9	1420891	59151-19-8	60826-15-5	623-30-3	6304-24-1	65155-45-5
1296065	56011-02-0	579-74-8	591-60-6	6091-50-5	623-36-9	6309-51-9	65330-49-6
1296855	560-88-3	579-75-9	591-68-4	611-13-2	623-37-0	6314-97-2	65405-67-6
1296920	56-12-2	579-93-1	591-80-0	61114-24-7	623-42-7	63187-91-7	65405-68-7
5454-19-3	5616-51-3	58-08-2	591-82-2	61197-09-9	623-70-1	1616205	65405-70-1
5454-21-7	56172-46-4	58214-97-4	59191-78-5	612-15-7	62395-45-3	63449-64-9	65405-72-3
5454-28-4	562-74-3	58296-81-4	592-20-1	61295-41-8	624-09-9	63449-68-3	65405-73-4
54546-26-8	56-40-6	583-04-0	59230-57-8	61295-44-1	624-24-8	63500-71-0	65405-76-7
5457-70-5	564-20-5	583-60-8	5925-68-8	61295-50-9	62439-41-2	635-46-1	65405-77-8
5458-59-3	564-94-3	5837-78-5	5925-75-7	61295-51-0	624-41-9	63759-55-7	65405-80-3
1299385	5655-61-8	583-92-6	59259-38-0	613-70-7	624-51-1	637-64-9	65405-84-7
1299690	5660-60-6	58430-94-7	592-82-5	61444-38-0	624-54-4	637-65-0	65416-14-0
54644-28-9	56700-78-8	585-25-1	592-84-7	61444-41-5	62488-56-6	63767-86-2	65423-25-8
546-49-6	56747-96-7	58567-11-6	592-88-1	614-99-3	624-89-5	637-78-5	65442-31-1
1301153	56767-18-1	585-84-2	593-08-8	615-10-1	624-92-0	6378-65-0	65443-14-3
546-79-2	56805-23-3	58625-96-0	59323-76-1	616-25-1	625-33-2	6380-23-0	65504-97-4
1301880	56-81-5	586-38-9	59324-17-3	61692-83-9	625-55-8	638-02-8	65505-16-0
5471-51-2	56836-93-2	586-62-9	59354-71-1	61692-84-0	625-60-5	638-11-9	65505-17-1
547-63-7	56-84-8	586-81-2	59376-58-8	61699-38-5	62563-80-8	638-17-5	65505-18-2
54814-64-1	56-85-9	586-82-3	5943-34-0	617-01-6	625-80-9	638-25-5	65505-24-0
54815-13-3	56-86-0	5870-68-8	59471-80-6	617-35-6	6258-63-5	638-49-3	65505-25-1
54830-99-8	56-87-1	5870-93-9	5947-36-4	617-50-5	625-86-5	638-53-9	65530-53-2
548774-80-7	56922-74-8	58-86-6	1477529	6175-49-1	6259-76-3	63-91-2	65588-69-4
54889-48-4	5694-72-4	588-67-0	59-51-8	61792-11-8	626-11-9	63986-03-8	6561-39-3
54947-74-9	56973-85-4	589-35-5	59558-23-5	61810-55-7	6263-65-6	64001-15-6	65620-50-0
54957-02-7	57-06-7	58936-30-4	5986-38-9	61826-53-7	626-38-0	64-04-0	656-53-1
54982-83-1	57074-37-0	589-38-8	598-75-4	619-01-2	626-77-7	1647153	65737-52-2
55066-48-3	57082-24-3	589-59-3	5988-91-0	61-90-5	626-82-4	6413-26-9	65813-53-8
55066-49-4	57094-40-3	589-66-2	5989-27-5	6191-71-5	1594715	64165-57-7	65817-24-5
55066-56-3	57-10-3	589-75-3	5989-54-8	61920-45-4	6270-56-0	64-17-5	65-85-0
551-08-6	57-11-4	589-82-2	600-14-6	61931-80-4	627-90-7	64-18-6	65887-08-3
551-93-9	57124-87-5	58985-18-5	600-18-0	61931-81-5	628-00-2	64187-83-3	65894-82-8
55253-28-6	5724-81-2	589-92-4	60047-17-8	620-02-0	628-03-5	64-19-7	65894-83-9
554-12-1	57345-19-4	589-98-0	60-12-8	620-23-5	6281-40-9	64275-73-6	659-70-1
55418-52-5	57378-68-4	590-01-2	60-18-4	620-79-1	6284-46-4	644-08-6	66062-78-0
5552-30-7	57500-00-2	59020-85-8	60241-53-4	62079-29-2	628-46-6	644-13-3	66068-84-6
5555-90-8	57-55-6	59020-90-5	60241-55-6	62147-49-3	628-63-7	644-35-9	66072-32-0
556-24-1	5756-24-1	59021-02-2	6028-61-1	621-82-9	628-97-7	644-49-5	6622-76-0
556-61-6	57568-60-2	59052-82-3	6032-29-7	6221-93-8	628-99-9	64461-99-0	6624-71-1
556-82-1	57576-09-7	5905-46-4	60-33-3	6222-35-1	6290-17-1	645-13-6	66-25-1
557-00-6	5760-50-9	5905-47-5	60335-71-9	622-39-9	6290-37-5	6454-22-4	6627-88-9
55704-78-4	576-26-1	59056-62-1	60-35-5	622-45-7	629-12-9	645-56-7	6628-18-8
55719-85-2	5764-85-2	59056-64-3	60415-61-4	622-62-8	629-19-6	6457-30-3	66327-54-6
557-48-2	577-16-2	59056-70-1	60523-21-9	622-78-6	629-33-4	64577-91-9	6635-22-9
55764-22-2	57743-63-2	590-86-3	606-45-1	623-05-2	629-45-8	646-07-1	1729185
55764-23-3	578-58-5	5910-87-2	6066-49-5	623-15-4	629-59-4	6485-40-1	66408-78-4
55764-25-5	57893-27-3	5910-89-4	60763-41-9	623-17-6	629-62-9	6493-80-7	66576-71-4

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6658-48-6	67801-44-9	68141-17-3	68901-15-5	70851-61-5	7361-80-0	75-07-0	7774-65-4
66634-97-7	67801-47-2	68155-66-8	68901-22-4	71-00-1	7367-81-9	75-08-1	77-74-7
66642-86-2	67801-64-3	68155-67-9	68901-32-6	710-04-3	7367-82-0	75147-23-8	7774-74-5
66848-40-6	67801-65-4	68213-87-6	68922-10-1	71048-82-3	7367-88-6	75-18-3	7774-79-0
67028-40-4	6784-13-0	68258-95-7	68922-11-2	71077-31-1	73757-27-4	75-21-8	7774-82-5
6707-60-4	67845-30-1	68259-33-6	68928-82-5	71159-90-5	7392-19-0	75-31-0	7774-96-1
6725-64-0	67845-42-5	68345-22-2	68959-28-4	71-23-8	7403-42-1	2056136	7775-00-0
6728-26-3	67845-46-9	68378-13-2	68966-86-9	71298-42-5	74094-60-3	75-33-2	7775-38-4
6728-31-0	67859-96-5	68391-29-7	689-67-8	71-36-3	74094-61-4	7540-51-4	7775-39-5
67355-38-8	67860-38-2	68391-39-9	689-89-4	713-95-1	74094-62-5	7540-53-6	7778-83-8
6738-23-4	67874-67-3	68398-18-5	68991-97-9	71-41-0	74094-63-6	7541-49-3	7778-87-2
67452-27-1	67874-69-5	68411-38-1	69038-78-4	7143-69-3	7416-35-5	7549-33-9	7778-96-3
675-09-2	67874-72-0	68419-46-5	69103-20-4	7149-26-0	74338-72-0	7549-37-3	7779-16-0
6753-98-6	67874-78-6	68480-06-8	6911-51-9	7149-29-3	74356-31-3	7549-41-9	7779-17-1
67601-05-2	67874-81-1	68480-08-0	6915-15-7	7149-32-8	74367-97-8	75-50-3	7779-23-9
67-63-0	67879-60-1	68480-11-5	6920-22-5	71500-37-3	74410-10-9	2063957	7779-30-8
67633-94-7	67883-79-8	68480-14-8	69226-05-7	1918228	7452-79-1	75853-49-5	7779-41-1
67633-96-9	6789-80-6	68480-15-9	692-86-4	71566-51-3	7460-74-4	759-05-7	7779-50-2
67633-97-0	6789-88-4	68480-25-1	69300-15-8	71566-53-5	74758-91-1	76-09-5	7779-65-9
67633-99-2	67905-40-2	68480-26-2	6931-54-0	71648-34-5	74758-93-3	762-26-5	7779-70-6
67634-00-8	6790-58-5	68480-27-3	693-54-9	71660-03-2	74-79-3	762-29-8	7779-72-8
67634-01-9	67919-67-9	68480-28-4	69382-62-3	71735-79-0	7492-37-7	76238-22-7	7779-73-9
67634-07-5	67920-63-2	68527-74-2	693-95-8	71832-76-3	7492-39-9	764-39-6	7779-75-1
67634-11-1	67952-59-4	68527-76-4	69486-14-2	72007-81-9	7492-41-3	764-40-9	7779-77-3
67634-14-4	67952-60-7	68527-77-5	695-06-7	72089-08-8	7492-44-6	76-49-3	7779-78-4
67634-15-5	67952-65-2	68555-53-3	6963-56-0	72117-72-7	7492-45-7	765-05-9	7779-80-8
67634-17-7	67999-56-8	68555-57-7	69668-87-7	7212-44-4	7492-65-1	76-50-6	7779-81-9
67634-20-2	6803-40-3	68555-58-8	69-72-7	7217-59-6	7492-66-2	765-70-8	7779-94-4
67634-22-4	68039-24-7	68555-59-9	6975-60-6	72-18-4	7492-67-3	7664-38-2	2146322
67634-23-5	68039-26-9	68555-61-3	6976-72-3	72214-23-4	7492-69-5	76649-14-4	77-83-8
67634-25-7	68039-29-2	68555-62-4	698-10-2	72257-53-5	7492-70-8	76649-16-6	7784-67-0
67634-26-8	68039-39-4	68555-63-5	698-27-1	72403-67-9	74-93-1	76649-17-7	7784-98-7
67-64-1	68039-44-1	68555-65-7	6986-51-2	72429-08-4	7493-57-4	76649-22-4	77851-07-1
67662-96-8	68039-47-4	68555-94-2	698-76-0	72437-56-0	7493-58-5	76649-23-5	7785-33-3
67663-01-8	68039-49-6	68555-95-3	69882-09-3	72437-68-4	7493-59-6	76649-26-8	7785-53-7
67674-36-6	68039-69-0	68683-20-5	699-10-5	7251-61-8	7493-63-2	766-92-7	7785-63-9
67674-46-8	68039-73-6	68683-25-0	699-17-2	72797-17-2	7493-65-4	76788-46-0	7785-66-2
67-68-5	68083-58-9	68698-57-7	69925-33-3	72854-42-3	7493-66-5	770-27-4	7786-29-0
67689-50-3	68084-03-7	68698-59-9	69929-16-4	72881-27-7	7493-68-7	77118-93-5	7786-47-2
67707-75-9	68084-04-8	68705-63-5	69929-17-5	72894-12-3	7493-69-8	77311-02-5	7786-48-3
67715-79-1	68127-22-0	68738-94-3	70092-23-8	7289-52-3	7493-71-2	7732-18-5	7786-58-5
67715-80-4	68132-80-9	68738-96-5	7011-83-8	72928-51-9	7493-72-3	774-55-0	7786-61-0
67739-11-1	68133-72-2	68738-99-8	70214-77-6	72928-52-0	7493-74-5	77-53-2	7787-20-4
67746-30-9	68133-73-3	68739-00-4	705-73-7	73003-91-5	7493-76-7	77-54-3	77-92-9
67770-79-0	68133-75-5	6876-13-7	705-86-2	1973383	7493-78-9	7756-96-9	77-93-0
67785-76-6	68133-76-6	68845-00-1	706-14-9	73157-43-4	7493-79-0	7764-50-3	78-35-3
67785-77-7	68133-77-7	68845-02-3	7070-15-7	7335-26-4	7493-80-3	77-70-3	78-36-4
67801-20-1	68133-78-8	68845-36-3	707-29-9	7341-17-5	7493-82-5	7774-44-9	78-37-5
67801-33-6	68133-79-9	68877-29-2	70788-30-6	73545-18-3	75-04-7	7774-47-2	78417-28-4
67801-38-1	68140-48-7	688-82-4	70851-60-4	73545-19-4	75048-15-6	7774-60-9	78-59-1

Table S4. CAS registry numbers for 2,683 odorants used to estimate the size of odorant space. Structure files were obtained from (http://www.thegoodscentscompany.com).

78649-62-4	82185-41-9	88-09-5	928-94-9	94406-15-2	99-48-9
78-69-3	823-22-3	88-15-3	928-95-0	94-46-2	99583-29-6
78-70-6	82356-51-2	881-68-5	928-96-1	94-47-3	996-97-4
78-81-9	82461-14-1	882-33-7	928-97-2	94-48-4	99-72-9
78-83-1	825-51-4	88-29-9	93-04-9	94-50-8	99-76-3
78-84-2	82654-98-6	88-41-5	93-08-3	94-62-2	99-83-2
78-93-3	82784-84-7	88-69-7	93-15-2	94-86-0	99-85-4
78-96-6	828-26-2	88-84-6	93-16-3	950-33-4	99-86-5
78-98-8	83-34-1	89-47-4	93-18-5	95-16-9	99-87-6
78989-37-4	83-66-9	89-48-5	93-19-6	95-21-6	99-93-4
79-09-4	83-67-0	89534-38-3	932-16-1	95-41-0	999-40-6
79-20-9	84012-64-6	89-65-6	93-28-7	95-48-7	99-96-7
79-31-2	84029-92-5	89-74-7	93-29-8	95-65-8	300-57-2
79-42-5	84029-93-6	89780-06-3	93-51-6	95-87-4	591-78-6
79-69-6	84434-18-4	89-78-1	93-53-8	95962-14-4	1455-21-6
79771-15-6	84642-60-4	89-79-2	93-54-9	96-04-8	94805-33-1
79-77-6	84642-61-5	89-81-6	93-55-0	96-15-1	938-79-4.
79-78-7	84-66-2	89-82-7	93-58-3	96-17-3	4286-15-1.
79-89-0	84681-92-5	89-83-8	93-60-7	96-26-4	1076-38-6.
79915-74-5	84697-09-6	89-86-1	937-30-4	96-48-0	130066-44-3.
79-92-5	84788-08-9	89-88-3	93762-35-7	96-54-8	464-48-2.
8007-35-0	85136-06-7	90-02-8	93840-90-5	97358-54-8	491-37-2.
80118-06-5	85213-22-5	9003-73-0	93-89-0	97358-55-9	5524-05-0.
80-25-1	85351-07-1	90-05-1	93905-03-4	97384-48-0	553-86-6.
80-26-2	85392-03-6	90-12-0	93-91-4	97-41-6	71-43-2.
80-27-3	85508-08-3	90-17-5	939-21-9	97-42-7	68-11-1
80417-97-6	85554-72-9	90397-38-9	93-92-5	97-45-0	123-92-2
80449-58-7	85586-67-0	90-42-6	93939-86-7	97-53-0	123-99-9
80480-24-6	85761-70-2	90-43-7	939-48-0	97-54-1	126-81-8
80-54-6	85-91-6	90530-04-4	93952-58-0	97-61-0	6033-23-4
80-56-8	86241-90-9	90-87-9	93981-50-1	97-62-1	6169-06-8
80-57-9	86803-90-9	91069-40-8	94-02-0	97-64-3	20487-40-5
80-59-1	868-57-5	91-10-1	94021-42-8	97-67-6	
80623-07-0	870-23-5	91-16-7	94087-23-7	97752-28-8	
80-62-6	87061-04-9	91-22-5	94087-83-9	97-85-8	
80657-64-3	87118-95-4	91482-37-0	94089-01-7	97-87-0	
80-71-7	87-19-4	91-60-1	94089-02-8	97890-13-6	
80858-47-5	87-20-7	91-61-2	94-13-3	97-89-2	
80866-83-7	87-22-9	91-62-3	94134-03-9	97-96-1	
81-14-1	87-25-2	91-64-5	94159-31-6	97-99-4	
81-15-2	87-29-6	91-87-2	94159-32-7	98-00-0	
814-67-5	87-41-2	92046-48-5	941-98-0	98-01-1	
816-66-0	87-44-5	92-48-8	94201-19-1	98-02-2	
81752-87-6	874-66-8	92-52-4	94201-73-7	98-52-2	
81782-77-6	874-90-8	925-78-0	94-26-8	98-53-3	
81783-01-9	87641-23-4	92585-24-5	94278-27-0	98-54-4	
81786-73-4	87641-24-5	927-49-1	94293-57-9	98-55-5	
81925-81-7	87-69-4	928-80-3	94-30-4	98-85-1	
821-41-0	87731-18-8	928-91-6	94346-09-5	98-86-2	
821-55-6	87-91-2	928-92-7	94386-48-8	98-89-5	

Table S4. CAS registry numbers for 2,683 odorants used to estimate the size of odorant space. Structure files were obtained from (http://www.thegoodscentscompany.com).

Property	Position in Alignment	Weight
Volume	24	1
Volume	31	1
Composition	43	1
Volume	52	1
Volume	71	1
Composition	86	1
Polarity	107	1
Composition	140	1
Polarity	149	1
Volume	160	1
Polarity	171	1
Polarity	210	1
Volume	255	2
Composition	257	1
Composition	267	2
Polarity	276	2

Table S5. 16 amino acid property descriptors that explain over 53% of the variance in our dataset. Note that some descriptors have a weight higher than one.