
Reference List

1. Abraham NM, Spors H, Carleton A, Margrie TW, Kuner T, Schaefer AT (2004) Maintaining accuracy at the expense of speed: stimulus similarity defines odor discrimination time in mice. *Neuron* 44: 865-876.
2. Akers RP, Getz WM (1993) Response of olfactory receptor neurons in honeybees to odorants and their binary mixtures. *J Comp Physiol A* 173: 169-185.
3. Aungst JL, Heyward PM, Puche AC, Karnup SV, Hayar A, Szabo G, Shipley MT (2003) Centre-surround inhibition among olfactory bulb glomeruli. *Nature* 426: 623-629.
4. Barbara GS, Zube C, Rybak J, Gauthier M, Grunewald B (2005) Acetylcholine, GABA and glutamate induce ionic currents in cultured antennal lobe neurons of the honeybee, *Apis mellifera*. *J Comp Physiol A*. 191: 823-836.
5. Bargmann CI (2006) Comparative chemosensation from receptors to ecology. *Nature* 444: 295-301.
6. Benton R, Sachse S, Michnick SW, Vosshall LB (2006) Atypical membrane topology and heteromeric function of *Drosophila* odorant receptors in vivo. *PLoS Biol* 4: e20.
7. Borst A (1983) Computation of olfactory signals in *Drosophila melanogaster*. *J Comp Physiol A* 152: 373-383.
8. Breer H (2003) Olfactory receptors: molecular basis for recognition and discrimination of odors. *Anal Bioanal Chem* 377: 427-433.
9. Broome BM, Jayaraman V, Laurent G (2006) Encoding and decoding of overlapping odor sequences. *Neuron* 51: 467-482.
10. Carlsson MA, Chong KY, Daniels W, Hansson BS, Pearce TC (2007) Component Information Is Preserved in Glomerular Responses to Binary Odor Mixtures in the Moth *Spodoptera littoralis*. *Chem Senses* Epub ahead of print.
11. Chandra S, Smith BH (1998) An analysis of synthetic processing of odor mixtures in the honeybee (*Apis mellifera*). *J Exp Biol* 201: 3113-3121.
12. Charpak S, Mertz J, Beaupaire E, Moreaux L, Delaney K (2001) Odor-evoked calcium signals in dendrites of rat mitral cells. *Proc Natl Acad Sci U S A* 98: 1230-1234.
13. Christensen TA, Lei H, Hildebrand JG (2003) Coordination of central odor representations through transient, non-oscillatory synchronization of glomerular output neurons. *Proc Natl Acad Sci U S A* 100: 11076-11081.

14. Christensen TA, Waldrop BR, Harrow ID, Hildebrand JG (1993) Local interneurons and information processing in the olfactory glomeruli of the moth *Manduca sexta*. *J Comp Physiol A* 173: 385-399.
15. Clyne PJ, Warr CG, Freeman MR, Lessing D, Kim J, Carlson JR (1999) A novel family of divergent seven-transmembrane proteins: candidate odorant receptors in *Drosophila*. *Neuron* 22: 327-338.
16. Cometto-Muniz JE, Cain WS, Abraham MH (2005) Odor detection of single chemicals and binary mixtures. *Behav Brain Res* 156: 115-123.
17. Couto A, Alenius M, Dickson BJ (2005) Molecular, anatomical, and functional organization of the *Drosophila* olfactory system. *Curr Biol* 15: 1535-1547.
18. Dahanukar A, Hallem EA, Carlson JR (2005) Insect chemoreception. *Curr Opin Neurobiol* 15: 423-430.
19. de Bruyne M, Clyne PJ, Carlson JR (1999) Odor coding in a model olfactory organ: the *Drosophila* maxillary palp. *J Neurosci* 19: 4520-4532.
20. de Bruyne M, Foster K, Carlson JR (2001) Odor coding in the *Drosophila* antenna. *Neuron* 30: 537-552.
21. Deisig N, Giurfa M, Lachnit H, Sandoz JC (2006) Neural representation of olfactory mixtures in the honeybee antennal lobe. *Eur J Neurosci* 24: 1161-1174.
22. Deisig N, Lachnit H, Giurfa M, Hellstern F (2001) Configural olfactory learning in honeybees: negative and positive patterning discrimination. *Learn Mem* 8: 70-78.
23. Deisig N, Lachnit H, Sandoz JC, Lober K, Giurfa M (2003) A modified version of the unique cue theory accounts for olfactory compound processing in honeybees. *Learn Mem* 10: 199-208.
24. Derby CD (2000) Learning from spiny lobsters about chemosensory coding of mixtures. *Physiol Behav* 69: 203-209.
25. Derby CD, Hutson M, Livermore BA, Lynn WH (1996) Generalization among related complex odorant mixtures and their components: Analysis of olfactory perception in the spiny lobster. *Physiol Behav* 60: 87-95.
26. Distler PG, Boeckh J (1996) Synaptic connection between olfactory receptor cells and uniglomerular projection neurons in the antennal lobe of the American cockroach, *Periplaneta americana*. *J Comp Neurol* 370: 35-46.
27. Distler PG, Boeckh J (1997) Synaptic connections between identified neuron types in the antennal lobe glomeruli of the cockroach, *Periplaneta americana*: II. Local multiglomerular interneurons. *J Comp Neurol* 383: 529-540.
28. Distler PG, Gruber C, Boeckh J (1998) Synaptic connections between GABA-immunoreactive neurons and uniglomerular projection neurons within the antennal lobe of the cockroach, *Periplaneta americana*. *Synapse* 29: 1-13.

29. Ditzen M, Evers JF, Galizia CG (2003) Odor similarity does not influence the time needed for odor processing. *Chem Senses* 28: 781-789.
30. Duchamp-Viret P, Duchamp A, Chaput MA (2003) Single olfactory sensory neurons simultaneously integrate the components of an odour mixture. *Eur J Neurosci* 18: 2690-2696.
31. Eisthen HL (2002) Why are olfactory systems of different animals so similar? *Brain Behav Evol* 59: 273-293.
32. Estes PS, Roos J, van der BA, Kelly RB, Krishnan KS, Ramaswami M (1996) Traffic of dynamin within individual *Drosophila* synaptic boutons relative to compartment-specific markers. *J Neurosci* 16: 5443-5456.
33. Fiala A, Spall T, Diegelmann S, Eisermann B, Sachse S, Devaud JM, Buchner E, Galizia CG (2002) Genetically expressed cameleon in *Drosophila melanogaster* is used to visualize olfactory information in projection neurons. *Curr Biol* 12: 1877-1884.
34. Firestein S (2001) How the olfactory system makes sense of scents. *Nature* 413: 211-218.
35. Fishilevich E, Vosshall LB (2005) Genetic and functional subdivision of the *Drosophila* antennal lobe. *Curr Biol* 15: 1548-1553.
36. Fonta C, Sun XJ, Masson C (1993) Morphology and spatial distribution of bee antennal lobe interneurons responsive to odours. *Chem Senses* 18: 101-119.
37. Friedrich RW, Laurent G (2001) Dynamic optimization of odor representations by slow temporal patterning of mitral cell activity. *Science* 291: 889-894.
38. Galan RF, Sachse S, Galizia CG, Herz AV (2004) Odor-driven attractor dynamics in the antennal lobe allow for simple and rapid olfactory pattern classification. *Neural Comput* 16: 999-1012.
39. Galizia CG, Kimmerle B (2004) Physiological and morphological characterization of honeybee olfactory neurons combining electrophysiology, calcium imaging and confocal microscopy. *J Comp Physiol A* 190: 21-38.
40. Galizia CG, Menzel R (2001) The role of glomeruli in the neural representation of odours: results from optical recording studies. *J Insect Physiol* 47: 115-130.
41. Gerber B, Stocker RF (2007) The *Drosophila* larva as a model for studying chemosensation and chemosensory learning: a review. *Chem Senses* 32: 65-89.
42. Giraudet P, Berthommier F, Chaput M (2002) Mitral cell temporal response patterns evoked by odor mixtures in the rat olfactory bulb. *J Neurophysiol* 88: 829-838.
43. Goldberg F, Grunewald B, Rosenboom H, Menzel R (1999) Nicotinic acetylcholine currents of cultured Kenyon cells from the mushroom bodies of the honey bee *Apis mellifera*. *J Physiol* 514 (Pt 3): 759-768.

44. Hallem EA, Carlson JR (2006) Coding of odors by a receptor repertoire. *Cell* 125: 143-160.
45. Hallem EA, Ho MG, Carlson JR (2004) The molecular basis of odor coding in the *Drosophila* antenna. *Cell* 117: 965-979.
46. Heinbockel T, Christensen TA, Hildebrand JG (2004) Representation of binary pheromone blends by glomerulus-specific olfactory projection neurons. *J Comp Physiol A* 190: 1023-1037.
47. Heisenberg M (2003) Mushroom body memoir: from maps to models. *Nat Rev Neurosci* 4: 266-275.
48. Hildebrand JG, Shepherd GM (1997) Mechanisms of olfactory discrimination: converging evidence for common principles across phyla. *Annu Rev Neurosci* 20: 595-631.
49. Jefferis GS, Hummel T (2006) Wiring specificity in the olfactory system. *Semin Cell Dev Biol* 17: 50-65.
50. Jefferis GS, Potter CJ, Chan AM, Marin EC, Rohlfsing T, Maurer CR, Jr., Luo L (2007) Comprehensive maps of *Drosophila* higher olfactory centers: spatially segregated fruit and pheromone representation. *Cell* 128: 1187-1203.
51. Jones WD, Cayirlioglu P, Kadow IG, Vosshall LB (2007) Two chemosensory receptors together mediate carbon dioxide detection in *Drosophila*. *Nature* 445: 86-90.
52. Jordan MJ, Tandon K, Shaw PE, Goodner KL (2001) Aromatic profile of aqueous banana essence and banana fruit by gas chromatography-mass spectrometry (GC-MS) and gas chromatography-olfactometry (GC-O). *J Agric Food Chem* 49: 4813-4817.
53. Kaissling KE (1996) Peripheral mechanisms of pheromone reception in moths. *Chem Senses* 21: 257-268.
54. Kay LM, Crk T, Thorngate J (2005) A redefinition of odor mixture quality. *Behav Neurosci* 119: 726-733.
55. Kay LM, Lowry CA, Jacobs HA (2003) Receptor contributions to configural and elemental odor mixture perception. *Behav Neurosci* 117: 1108-1114.
56. Korsching SI (2001) Odor maps in the brain: spatial aspects of odor representation in sensory surface and olfactory bulb. *Cell Mol Life Sci* 58: 520-530.
57. Kurtz R, Warzecha AK, Egelhaaf M (2001) Transfer of visual motion information via graded synapses operates linearly in the natural activity range. *J Neurosci* 21: 6957-6966.
58. Kwon JY, Dahanukar A, Weiss LA, Carlson JR (2007) The molecular basis of CO₂ reception in *Drosophila*. *Proc Natl Acad Sci U S A* 104: 3574-3578.
59. Laing DG (1987) Coding of chemosensory stimulus mixtures. *Ann N Y Acad Sci* 510: 61-66.

60. Laing DG, Francis GW (1989) The Capacity of Humans to Identify Odors in Mixtures. *Physiol Behav* 46: 809-814.
61. Laissue PP, Reiter C, Hiesinger PR, Halter S, Fischbach KF, Stocker RF (1999) Three-dimensional reconstruction of the antennal lobe in *Drosophila melanogaster*. *J Comp Neurol* 405: 543-552.
62. Larsson MC, Domingos AI, Jones WD, Chiappe ME, Amrein H, Vosshall LB (2004) Or83b encodes a broadly expressed odorant receptor essential for *Drosophila* olfaction. *Neuron* 43: 703-714.
63. Laurent G (1996) Dynamical representation of odors by oscillating and evolving neural assemblies. *Trends Neurosci* 19: 489-496.
64. Laurent G (2002) Olfactory network dynamics and the coding of multidimensional signals. *Nat Rev Neurosci* 3: 884-895.
65. Lei H, Christensen TA, Hildebrand JG (2004) Spatial and temporal organization of ensemble representations for different odor classes in the moth antennal lobe. *J Neurosci* 24: 11108-11119.
66. Lei H, Mooney R, Katz LC (2006) Synaptic integration of olfactory information in mouse anterior olfactory nucleus. *J Neurosci* 26: 12023-12032.
67. Lin DY, Zhang SZ, Block E, Katz LC (2005) Encoding social signals in the mouse main olfactory bulb. *Nature* 434: 470-477.
68. Linn CE, Jr., Roelofs WL (1989) Response specificity of male moths to multicomponent pheromones. *Chem Senses* 14: 421-437.
69. Linster C, Sachse S, Galizia CG (2005) Computational modeling suggests that response properties rather than spatial position determine connectivity between olfactory glomeruli. *J Neurophysiol* 93: 3410-3417.
70. Livermore A, Laing DG (1996) Influence of training and experience on the perception of multicomponent odor mixtures. *J Exp Psych* 22: 267-277.
71. Malun D, Waldow U, Kraus D, Boeckh J (1993) Connections between the deutocerebrum and the protocerebrum, and neuroanatomy of several classes of deutocerebral projection neurons in the brain of male *Periplaneta americana*. *J Comp Neurol* 329: 143-162.
72. Marin EC, Jefferis GS, Komiyama T, Zhu H, Luo L (2002) Representation of the glomerular olfactory map in the *Drosophila* brain. *Cell* 109: 243-255.
73. McGann JP, Pirez N, Gainey MA, Muratore C, Elias AS, Wachowiak M (2005) Odorant representations are modulated by intra- but not interglomerular presynaptic inhibition of olfactory sensory neurons. *Neuron* 48: 1039-1053.
74. McGill R, Tuckey JW, Larson WA (1978) Variations of box plots. *The American Statistician* 32: 12-16.

75. Mombaerts P (2006) Axonal wiring in the mouse olfactory system. *Annu Rev Cell Dev Biol* 22: 713-737.
76. Mombaerts P, Wang F, Dulac C, Chao SK, Nemes A, Mendelsohn M, Edmondson J, Axel R (1996) Visualizing an olfactory sensory map. *Cell* 87: 675-686.
77. Nakai J, Ohkura M, Imoto K (2001) A high signal-to-noise Ca(2+) probe composed of a single green fluorescent protein. *Nat Biotechnol* 19: 137-141.
78. Ng M, Roorda RD, Lima SQ, Zemelman BV, Morcillo P, Miesenbock G (2002) Transmission of olfactory information between three populations of neurons in the antennal lobe of the fly. *Neuron* 36: 463-474.
79. Oertner TG, Single S, Borst A (1999) Separation of voltage- and ligand-gated calcium influx in locust neurons by optical imaging. *Neurosci Lett* 274: 95-98.
80. Oka Y, Omura M, Kataoka H, Touhara K (2004) Olfactory receptor antagonism between odorants. *EMBO J* 23: 120-126.
81. Olsen SR, Bhandawat V, Wilson RI (2007) Excitatory Interactions between Olfactory Processing Channels in the *Drosophila* Antennal Lobe. *Neuron* 54: 89-103.
82. Pelz C, Gerber B, Menzel R (1997) Odorant intensity as a determinant for olfactory conditioning in honeybees: roles in discrimination, overshadowing and memory consolidation. *J Exp Biol* 200: 837-847.
83. Pelz D, Roeske T, Syed Z, de Bruyne M, Galizia CG (2006) The molecular receptive range of an olfactory receptor in vivo (*Drosophila melanogaster* Or22a). *J Neurobiol* 66: 1544-1563.
84. Perez-Orive J, Mazor O, Turner GC, Cassenaer S, Wilson RI, Laurent G (2002) Oscillations and sparsening of odor representations in the mushroom body. *Science* 297: 359-365.
85. Pichersky E, Gershenzon J (2002) The formation and function of plant volatiles: perfumes for pollinator attraction and defense. *Curr Opin Plant Biol* 5: 1-7.
86. Sachse S, Galizia CG (2002) Role of inhibition for temporal and spatial odor representation in olfactory output neurons: a calcium imaging study. *J Neurophysiol* 87: 1106-1117.
87. Sachse S, Galizia CG (2003) The coding of odour-intensity in the honeybee antennal lobe: local computation optimizes odour representation. *Eur J Neurosci* 18: 2119-2132.
88. Sachse S, Galizia CG (2006) Topography and Dynamics of the Olfactory System. In: *Microcircuits: the Interface between Neurons and Global Brain Function*. (Grillner S and Graybiel AM, ed), pp 251-274. Cambridge: The MIT Press.
89. Shanbhag SR, Muller B, Steinbrecht RA (1999) Atlas of olfactory organs of *Drosophila melanogaster*: 1. Types, external organization, innervation and distribution of olfactory sensilla. *Int J Insect Morphol and Embryol* 28: 377-397.

90. Shang Y, Claridge-Chang A, Sjulson L, Pypaert M, Miesenbock G (2007) Excitatory local circuits and their implications for olfactory processing in the fly antennal lobe. *Cell* 128: 601-612.
91. Shepherd GM, Chen WR, Greer CA (2004) Olfactory Bulb. In: *The Synaptic Organization of the Brain* (Shepherd GM, ed), pp 165-216. New York: Oxford University Press.
92. Single S, Borst A (2002) Different mechanisms of calcium entry within different dendritic compartments. *J Neurophysiol* 87: 1616-1624.
93. Smith BH (1998) Analysis of interaction in binary odorant mixtures. *Physiol Behav* 65: 397-407.
94. Smith DP (2007) Odor and pheromone detection in *Drosophila melanogaster*. *Pflugers Arch* Epub ahead of print.
95. Stocker RF (1994) The organization of the chemosensory system in *Drosophila melanogaster*: a review. *Cell Tiss Res* 275: 3-26.
96. Stocker RF (2001) *Drosophila* as a focus in olfactory research: mapping of olfactory sensilla by fine structure, odor specificity, odorant receptor expression, and central connectivity. *Microsc Res Tech* 55: 284-296.
97. Stocker RF, Heimbeck G, Gendre N, de Belle JS (1997) Neuroblast ablation in *Drosophila* P[GAL4] lines reveals origins of olfactory interneurons. *J Neurobiol* 32: 443-456.
98. Stocker RF, Lienhard MC, Borst A, Fischbach KF (1990) Neuronal architecture of the antennal lobe in *Drosophila melanogaster*. *Cell Tiss Res* 262: 9-34.
99. Sun XJ, Fonta C, Masson C (1993) Odour quality processing by bee antennal lobe interneurons. *Chem Senses* 18: 355-377.
100. Svoboda K, Denk W, Kleinfeld D, Tank DW (1997) In vivo dendritic calcium dynamics in neocortical pyramidal neurons. *Nature* 385: 161-165.
101. Szyszka P, Ditzen M, Galkin A, Galizia CG, Menzel R (2005) Sparsening and temporal sharpening of olfactory representations in the honeybee mushroom bodies. *J Neurophysiol* 94:3303-13.
102. Tabor R, Yaksi E, Weislogel JM, Friedrich RW (2004) Processing of odor mixtures in the zebrafish olfactory bulb. *J Neurosci* 24: 6611-6620.
103. Uchida N, Mainen ZF (2003) Speed and accuracy of olfactory discrimination in the rat. *Nature Neuroscience* 6: 1224-1229.
104. Vickers NJ (2006) Winging it: moth flight behavior and responses of olfactory neurons are shaped by pheromone plume dynamics. *Chem Senses* 31: 155-166.
105. Vosshall LB (2000) Olfaction in *Drosophila*. *Curr Opin Neurobiol* 10: 498-503.

106. Vosshall LB, Amrein H, Morozov PS, Rzhetsky A, Axel R (1999) A spatial map of olfactory receptor expression in the *Drosophila* antenna. *Cell* 96: 725-736.
107. Vosshall LB, Wong AM, Axel R (2000) An olfactory sensory map in the fly brain. *Cell* 102: 147-159.
108. Wachowiak M, Cohen LB, Ache BW (2002) Presynaptic inhibition of olfactory receptor neurons in crustaceans. *Microsc Res Tech* 58: 365-375.
109. Wachowiak M, McGann JP, Heyward PM, Shao Z, Puche AC, Shipley MT (2005) Inhibition of olfactory receptor neuron input to olfactory bulb glomeruli mediated by suppression of presynaptic calcium influx. *J Neurophysiol* 94:2700-12..
110. Wang JW, Wong AM, Flores J, Vosshall LB, Axel R (2003) Two-photon calcium imaging reveals an odor-evoked map of activity in the fly brain. *Cell* 112: 271-282.
111. Wang Y, Guo HF, Pologruto TA, Hannan F, Hakker I, Svoboda K, Zhong Y (2004) Stereotyped odor-evoked activity in the mushroom body of *Drosophila* revealed by green fluorescent protein-based Ca²⁺ imaging. *J Neurosci* 24: 6507-6514.
112. Wilson DA, Stevenson RJ (2003) Olfactory perceptual learning: the critical role of memory in odor discrimination. *Neurosci Biobehav Rev* 27: 307-328.
113. Wilson RI, Laurent G (2005) Role of GABAergic inhibition in shaping odor-evoked spatiotemporal patterns in the *Drosophila* antennal lobe. *J Neurosci* 25: 9069-9079.
114. Wilson RI, Turner GC, Laurent G (2004) Transformation of olfactory representations in the *Drosophila* antennal lobe. *Science* 303: 366-370.
115. Wilson RI, Mainen ZF (2006) Early events in olfactory processing. *Ann Rev Neurosci* 29: 163-201.
116. Wiltrout C, Dogra S, Linster C (2003) Configurational and nonconfigurational interactions between odorants in binary mixtures. *Behav Neurosci* 117: 236-245.
117. Wong AM, Wang JW, Axel R (2002) Spatial representation of the glomerular map in the *Drosophila* protocerebrum. *Cell* 109: 229-241.
118. Yao CA, Ignell R, Carlson JR (2005) Chemosensory coding by neurons in the coeloconic sensilla of the *Drosophila* antenna. *J Neurosci* 25: 8359-8367.
119. Yokoi M, Mori K, Nakanishi S (1995) Refinement of odor molecule tuning by dendrodendritic synaptic inhibition in the olfactory bulb. *Proc Natl Acad Sci U S A* 92: 3371-3375.
120. Zou Z, Buck LB (2006) Combinatorial effects of odorant mixes in olfactory cortex. *Science* 311: 1477-1481.
121. Zou Z, Horowitz LF, Montmayeur JP, Snapper S, Buck LB (2001) Genetic tracing reveals a stereotyped sensory map in the olfactory cortex. *Nature* 414: 173-179.
122. Zou Z, Li F, Buck LB (2005) Odor maps in the olfactory cortex. *Proc Natl Acad Sci U S A* 102: 7724-7729.